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POTATOES

FOR PROFIT

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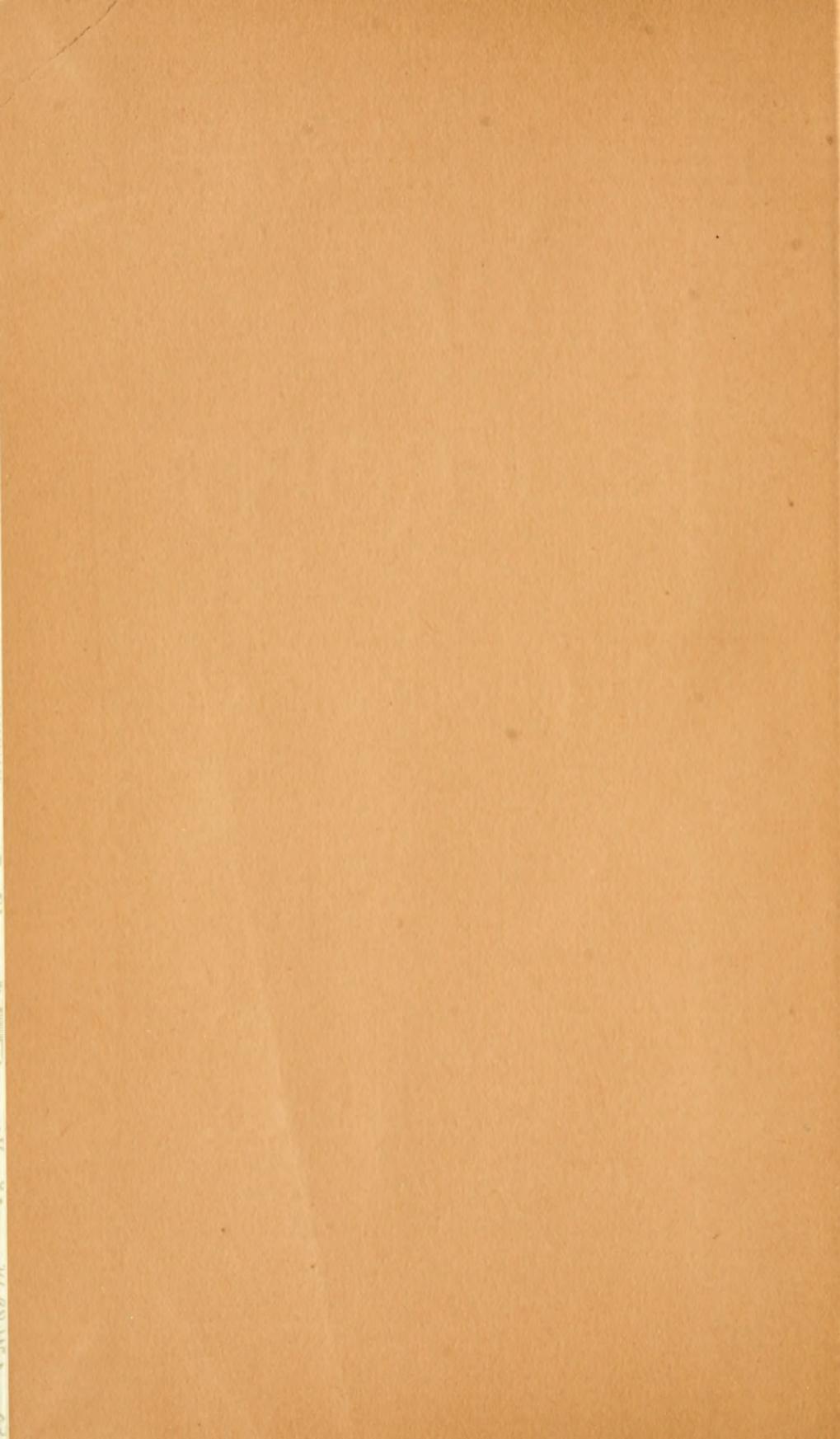
F. B. VAN ORNAM



PUBLISHED BY

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PHILADELPHIA

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POTATOES FOR PROFIT.

VAN ORNAM.

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PUBLISHED BY
W. ATLEE BURPEE & CO.,
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1896.

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WM. F. FELL & CO.,
ELECTROTYPERS AND PRINTERS,
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PUBLISHERS' PREFACE.

Experience has clearly proved that we can build upon no surer foundation, both for our patrons and for ourselves, than by disseminating among planters the best thought and practice of advanced farmers and horticulturists.

Good books on rural topics, have, as a rule, been high-priced in America. This has been due to the fact that such works have usually been confined to small editions and have been addressed to a limited circle of readers. In a country so vast, with such diversified agricultural interests, and with the most intelligent rural population in the world, this should not be the case; the best farm literature should be for the million as well as the few. With the rapid expansion of our seed business has grown an extraordinary demand for useful books on farm and garden topics. Indeed, it is this universal spirit of inquiry that has made possible the marvelous growth of our publishing department.

In no field, during recent years, has literary activity been more prolific in fruitful achievement, and in none have the labors of practical writers been welcomed with greater enthusiasm.

The author of the present volume is one of the best-known

potato growers of the country, and is the originator of standard varieties of world-wide celebrity.

Mr. Van Ornam's work has been edited in our publishing department, and chapters added on Chemical Fertilizers, Insect Enemies, and Fungous Diseases.

The story of his experience as a potato grower, covering more than a third of the century, cannot fail, we believe, to interest and prove profitable to all who read his book.

W. A. B. & Co.

PHILADELPHIA, *January, 1895.*

AUTHOR'S PREFACE.

The increase in the production of the potato has by no means kept pace with the increase in population. We are to-day the sixth nation in point of production, while the per capita consumption is much below that of many other nations. This, we believe to be partially due to the fact that prices, on a whole, have ruled higher in this country for potatoes than for many other staple articles of food.

Among nations we are not only the heaviest importers, except Austria-Hungary, and the smallest exporters,—our exportations being mostly for seed,—but we are almost the smallest in per capita consumption.

The following tables of production, imports, and exportations, taken from the *Rural New-Yorker*, December 16th, 1893, are most significant :—

	<i>Production.</i> <i>Bushels.</i>	<i>Exports.</i> <i>Bushels.</i>	<i>Imports.</i> <i>Bushels.</i>
Germany,	891,723,040	6,538,079	1,709,336
France,	396,746,138	4,634,800	779,618
Russia-Poland, . . .	464,441,187	1,257,323	13,604
Austria Hungary, . .	409,368,793	536,564	5,334,665
United Kingdom, . .	228,093,397	. . . . .	777,589
United States, . . .	169,809,053	465,059	3,033,504
Canada,	61,669,009	3,784,367	65,294
Belgium,	99,486,505	679,692	2,783,649

These figures are, for the most part, the averages of six or seven years. They show that Americans are using fewer potatoes per capita than any of the other great nations. Not only do we import over 3,000,000 bushels, but of over 10,000,000 bushels imported into the United Kingdom, and by five of the great nations of the continent, we do not supply a single bushel.

The Report of the Secretary of Agriculture for 1893 shows that the average yield per acre for the whole country is much below that of fifteen years ago. The estimated crop area for 1893 is 2,605,186 acres, and the product 183,034,203 bushels, an average yield per acre of 70.3 bushels. Surely, in the foregoing figures there is food for reflection.

Why do we not supply the home market, and why are our exports practically nothing in comparison with the exportations of less favored nations?

The tuber is easily grown, and land that will produce a crop of clover will generally return an excellent yield of potatoes, while under high culture, the crop responds enormously. In a country abounding with the best potato-producing lands in the world, with the most improved machinery for planting and harvesting the crop, and with the markets of the world open to our farmers, we should lead the world in the production of this enormous food supply. Yet it is quite evident that the American farmer is not making the most of his opportunities with the potato.

F. B. VAN ORNAM.

LEWIS, IOWA, *January, 1895.*

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POTATOES FOR PROFIT.

CHAPTER I.

INTRODUCTION.

The native home of the species from which our many varieties of potatoes have originated, is believed to be the high mountain region of South America, within those vast territories which once comprised the ancient Empire of Peru.

“ High up on the slopes of the Cordilleras,” says the historian of the Empire of the Incas, “ beyond the limits of the maize and of the quanda—a grain bearing some resemblance to rice, and largely cultivated by the Indians—was to be found the potato, the introduction of which into Europe has made an era in the history of agriculture. Whether indigenous to Peru, or imported from the neighboring country of Chili, it formed the great staple of the more elevated plains under the Incas, and its culture was continued to a height in the equatorial regions which reached many thousand feet above the limits of perpetual snow in the temperate latitudes of Europe. Wild specimens of the vegetable might be seen still higher, springing up spontaneously amidst the stunted shrubs that clothed the lofty sides of the Cordilleras, till these gradually subsided into mosses and the short, yellow grass, pajonal, which, like a golden carpet, was unrolled around the base of the mighty cones that rose far into the regions of eternal silence, covered with the snows of centuries.” Prescott’s “Conquest of Peru,” Vol. I, page 144.

The early Spanish discoverers found the potato in Chili, Peru, New Granada, and all along the chain of the Andes. Humboldt, who bestowed much study on the early history of the plant, says it was unknown to the ancient Mexicans, an opinion confirmed by the concurrent testimony of many travelers and writers. It was also unknown to the aborigines in the eastern temperate regions of South America.

There is a vast amount of conflicting testimony regarding the introduction of the potato into western Europe. It is believed to have been brought into Spain from Quito, by Spanish adventurers, in the early part of the sixteenth century. From Spain the potato passed into Italy, and from thence was carried into Mons by some one in attendance on the papal legate in Belgium. In 1588* Phillippe de Sivry, Seigneur of Waldheim, and Governor of Mons, sent the tuber to the celebrated botanist, Clusius, at Vienna, who states that in a short time it spread rapidly throughout Germany. Clusius published the first good description and illustration of the potato under the name of *Papas Peruanorum*. From his description, the species seems to have changed but little under three centuries of culture. Clusius describes the flowers as more or less pink externally, and reddish within, with five longitudinal stripes of green, as is often seen at the present time. He compares the odor of the flower with that of the lime. Clusius asserts that the species had been introduced into Italy from Spain or America, and expresses surprise that, although the plant had become so common in Italy that it was eaten like a turnip and fed to the pigs, yet the learned men of Padua only became acquainted with it by means of the tuber which he sent them. It is, however, questionable if the potato was so widely cultivated in Italy at this time as Clusius asserts, but he quotes Father Magazzini, of Vallombrosa, whose posthumous work,

* Some authorities say 1598.

published in 1623, mentions the species as one previously brought, without naming the date, from Spain or Portugal, by barefooted friars.*

There can, we think, be little doubt but that the Spaniards introduced the tubers into Spain, from whence they were carried into Italy, to the Netherlands, Lorraine, Switzerland and Germany. According to MM. Vilmorin-Andrieux, the potato did not become common in the central and northern districts of France until after Parmentier's labors made known its true value as a source of food supply.

The date of the introduction of the potato into the British Isles has been a subject of much discussion, but it is very generally believed that the first specimens grown in Britain were brought from Virginia by colonists sent out by Sir Walter Raleigh in 1584, who returned in 1586.

Humboldt supposed that the cultivation of the tuber in Virginia, where it was known to the early colonists, must have been originally received from the Spanish colonies at the south. De Candolle ("Origin of Cultivated Plants") is of the impression that the potato was introduced into that part of the United States now known as Virginia and the Carolinas in the early part of the sixteenth century. In his opinion the potato could scarcely have been introduced into Virginia or Carolina in Sir Walter Raleigh's time unless the ancient Mexicans had possessed it, and its cultivation had been diffused among the aborigines to the north of Mexico.

De Candolle says ("Origin of Cultivated Plants,"), "Dr. Rowlon, who carefully studied the works on North America, has assured me that he has found no signs of the potato in the United States before the arrival of the Europeans. Dr. Asa Gray also told me, adding that Mr. Harris, one of the men most intimately acquainted with the language of the

* De Candolle: "Origin of Cultivated Plants."

North American tribes, was of the same opinion. And," continues De Candolle, "I have read nothing to the contrary in recent publications, and we must not forget that a plant so easy of cultivation would have spread itself, even among nomadic tribes, had they possessed it. It seems to me most likely that some inhabitants of Virginia,—perhaps the English colonists,—received tubers from Spanish or other travelers, traders or adventurers, during the ninety years which had elapsed since the discovery of America. Evidently, dating from the conquest of Peru and Chili in 1535 to 1585, many vessels could have carried tubers of the potato as provisions, and Sir Walter Raleigh, making war on the Spaniards as a privateer, may have pillaged some vessel which contained them. This is the less improbable, since the Spaniards had introduced the plant into Europe before 1585."

Thomas Herriot, who accompanied Sir Walter Raleigh in several voyages, brought the first potatoes into Britain in 1586. They were planted on Sir Walter's estate near Cork, and were used for food in Ireland long before they were even known in England.

In some French works Parmentier is credited with having introduced the potato to Europeans, but his part in the matter was simply that of an enthusiast, who rendered its cultivation more popular.

In the time of James I (1566-1625) potatoes were so rare in England as to cost two shillings (sterling) a pound, and are mentioned in 1619 among the supplies provided for the royal household. In 1633 their value as food had become more generally known, and they were deemed worthy of notice by the Royal Society, which encouraged their cultivation with a view to the prevention of famine; but it was not until nearly a century later that measures were taken which led to their extensive culture in English husbandry.

CHAPTER II.

SOIL AND PREPARATION.

If the land is properly prepared a great variety of soils may be used for potato growing—clay, sandy loam, or deep, black prairie loam—any well drained soil,—but it must be rich and warm, and made mellow by thorough preparation. The ideal soil for this crop is a friable loam, moderately dry, with good natural or artificial drainage. Low, damp, or soggy land will not produce a good quality of potatoes, and the crop is more liable to be diseased. I always choose high, dry land for this crop, and prefer a light, sandy loam or a loose clay with a porous subsoil. This is of the greatest importance in determining the quality as well as the quantity of the crop. I have always found a porous or open subsoil the best. It will not only thoroughly drain the upper soil during and after a wet spell, but the land will the better withstand a long continued drought, supplying soil moisture from below at a time when the crop most needs it. This has never been more fully exemplified than during the past few excessively hot and dry seasons in Iowa.

Do not undertake to raise potatoes on heavy soil unless it has first been underdrained. Fortunately this is often feasible. Too much care cannot be taken in the preparation of the soil. I believe that fully one-half of the crop is often sacrificed by careless preparation of the land. Even the best farmers, when over-rushed with work at planting time, are tempted to slight the work with the hope of making up for the neglect in after cultivation. This, however, can never be done. After the

land is once planted it can never be stirred directly under the hills, where there is the most need of perfect tilth.

The land should be deeply plowed, care being taken that

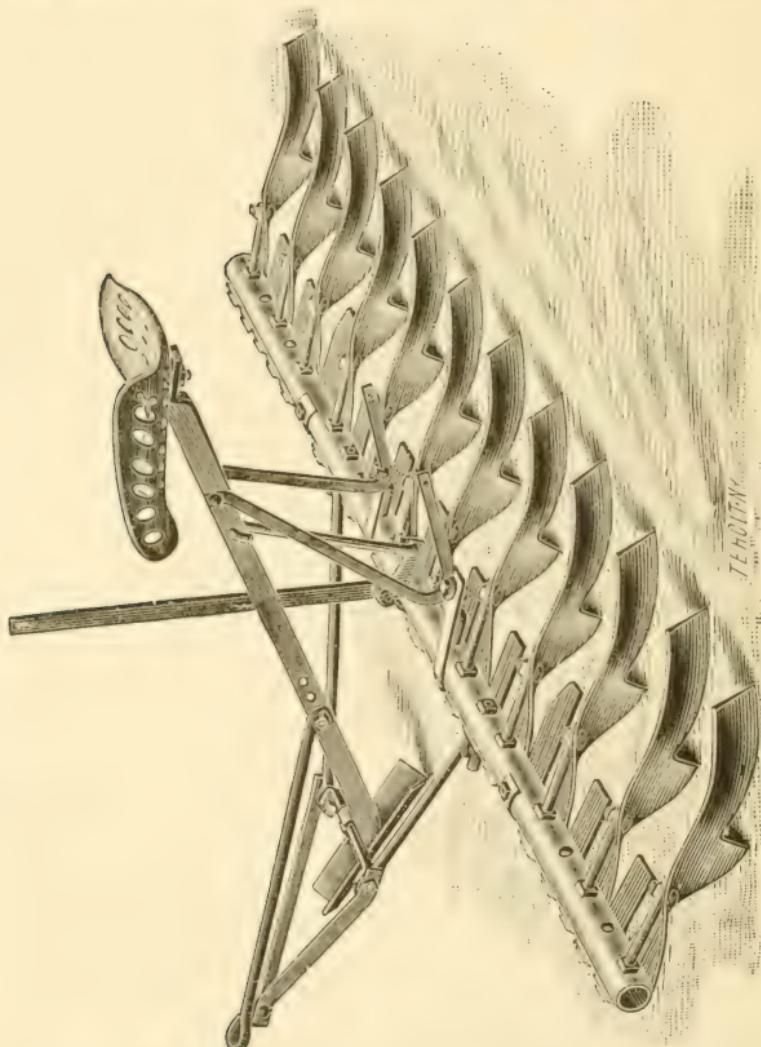


FIG. 1.—Acme Pulverizing Harrow.

there are no breaks in the plowing. No wider furrow than the plow is made to cut should be made, and it is best not to put the plow to its full capacity if thorough work is wanted. After the land has been broken it should be thoroughly pul-

verized, either with a disk harrow, a cutaway or some other good tool. In my own work I have never found a tool that will do this work so well as the Acme Pulverizing Harrow. With this implement no other harrow is needed in preparing the soil for a crop. It crushes the clods, cuts, turns and pulverizes the soil, smoothing the surface and leaving the trash buried where left by the plow. But whatever tool may be used, go over and over the land. It cannot be made too fine, and the extra work will be amply compensated for, and will show in the after culture and increase of crop.

CHAPTER III.

MANURES AND CHEMICAL FERTILIZERS.

I.—MANURES.

I have had but little experience with chemical fertilizers, simply because I have lived and farmed for thirty-five years in fertile Iowa. We have had new land at hand in generous supply for our potato crop, or could bring back our soil to almost, if not quite, its original fertility by simply seeding down to clover, and with the use of farmyard manure, which could be had for the hauling. A good plan is to compost the accumulated stable manure of the previous season with such refuse materials as may be at hand, and at our convenience in the fall to spread it on the clover sod. It should be evenly distributed over the surface to be plowed under the next spring. It does not pay to put manure in the hill or drill in large field culture. Fresh manure made during the winter and spring should not be used. In my experience the rotted manure of a previous season is always the best.

The day is near at hand when I think it will pay every potato grower to use chemical manures. The chief drawback with the western cultivator heretofore has been the distance these fertilizers have had to be shipped, as most of those of acknowledged merit were manufactured in the East. Again, the markets of the West for potatoes have not been so stable as those of the East; the price has often fluctuated so greatly as to change the result from profit to one of actual loss; the grower could not figure with any degree of certainty what he

could afford to pay for fertilizers, even though he knew just what increase of crop to credit to their use.

But these conditions are rapidly changing. Increased railway and water transportation facilities each year bring us in closer competition with our eastern brothers, while fertilizer factories are springing into existence in many of our larger western cities. Vast quantities of crude materials which were formerly shipped to the East to be made up into fertilizers are now being utilized at home.

Every year our lands are growing older and less able to stand the drain upon their fertility. Farmers who have been burning their straw and allowing the stable manure to be washed down our rivers and creeks, are learning, to their sorrow, the folly of so wasteful and improvident a system of farming.

II.—CHEMICAL FERTILIZERS.

An average crop of potatoes removes from the soil of one acre about 119 pounds of nitrogen, 55 pounds of phosphoric acid, and 192 pounds of potash. If we formulate a fertilizer on this basis, which is that indicated by analysis of the plant,—roots, stalks, leaves, stems and tubers,—the ratio of fertilizing constituents would be about two parts of nitrogen to one part of phosphoric acid to three parts of potash. But experience in the field, especially with soils that have been long under cultivation, indicates that a well balanced potato fertilizer should contain a slight excess of nitrogen, phosphoric acid, and potash, over these quantities.

Theoretically, a complete potato fertilizer should contain, in soluble forms, about six per cent. of nitrogen, three per cent. of phosphoric acid, and ten per cent. of potash. But generally in practice six per cent. of nitrogen, five to six per cent. of phosphoric acid, and from eight to ten per cent. of potash, will provide a better balanced mixture.

Now how shall we get this mixture in the best forms of raw materials and at the lowest cost to the farmer? Experience has taught us that the potato, like many other plants, seems to thrive best on particular forms of food, even under the most favorable conditions of soil and season. Thus we find nitrogen in the forms of nitrate of soda and dried blood especially favorable to its growth; phosphoric acid in dissolved bone-black, and potash as high-grade sulphate and wood ashes seem better forms of the latter than kainit or muriate of potash.

Let us decide to have a special, high-grade, complete fertilizer containing six per cent. of nitrogen, five per cent. of available phosphoric acid, and ten per cent. of potash. Now, it is obvious that the number of pounds of nitrogen, phosphoric acid, and potash contained in one ton (2000 pounds) of fertilizer is to be ascertained by multiplying one ton (2000 pounds) by the percentage of each fertilizing constituent; thus:

$$\begin{aligned} 2000 \text{ pounds} &\times .06 = 120.00 \text{ pounds of nitrogen,} \\ 2000 \quad " &\times .05 = 100.00 \quad " \quad " \text{ phosphoric acid,} \\ 2000 \quad " &\times .10 = 200.00 \quad " \quad " \text{ potash.} \end{aligned}$$

In selecting our nitrogen we should like to have it in the three forms of nitric acid, ammonia, and organic nitrogen. The cheapest source of the first of these forms is the familiar nitrate of soda of commerce. Sulphate of ammonia furnishes a highly concentrated ammonium salt for the second form; this salt is very largely used in the manufacture of chemical manures. It resembles common salt in appearance, and is not so liable to form hard lumps as is the case with nitrate of soda.

Organic nitrogen may be had in many animal and vegetable waste products. Some forms of organic nitrogen, like dried blood, meat and fish scrap, tankage, cotton seed meal, or castor pomace, are very active and valuable fertilizers, while others, like horn, hoof, hair, and leather, are so slow in their

action as to be practically inert when used for quick-growing crops.

In a well-prepared fertilizer it is desirable to have nitrogen in these three forms, that is as *nitric*, *ammoniac*, and *organic* nitrogen, or if one of these is inadmissible because of scarcity or high price, then two of the forms should be selected. Sulphate of ammonia sometimes gets so high that its use is not warranted in agriculture; farmers can buy nitrogen much cheaper in other forms which we regard as fully equal to ammonia salts.

"What," we may ask, "does the market afford as an economical source of nitrogen for the potato crop?"

At all times there is an abundance of such materials, and a little intelligent inquiry is all that is necessary to bring them to light. Dried blood and meat scrap contain from 10 to 11.50 per cent. of nitrogen. Dried fish scrap seven to eight per cent., castor pomace five per cent., and cotton seed meal over six per cent. of nitrogen.

Nitrogen in fine ground, dried meat, dried blood and fish, we believe to be of equal value with ammoniac nitrogen. Sir J. B. Lawes and Professor S. W. Johnson place a higher value on nitric nitrogen than on the nitrogen of ammonia, and we believe this will be the final decision of chemists.

We know that nitrate of soda and dried blood are both excellent sources of nitrogen for our crop, and we decide to take our 120 pounds of nitrogen in equal parts from these two sources of supply. Commercial nitrate of soda (96 per cent.) contains 15.81 per cent. of nitrogen, and dried blood contains about 10.50 per cent. of nitrogen. We will take this element in about equal proportions from both materials; therefore, to obtain 60 pounds of nitrogen from each of these sources it will take as many hundred pounds of nitrate of soda as 15.81 is contained in 60, and as many hundred pounds of

dried blood as 10.50 is contained in 60. Hence we have—

$$60 \div 0.1581 = 379 \text{ pounds nitrate soda}, \\ 60 \div 0.1050 = 570 \quad " \quad \text{dried blood}.$$

We will take the phosphoric acid from dissolved bone-black, which contains about 17 per cent. of available phosphoric acid. To obtain the 100 pounds of phosphoric acid we require—

$$100 \div 0.17 = 588 \text{ pounds.}$$

The most desirable of the Stassfurt potash salts for potatoes is the high-grade sulphate. We will take our 200 pounds of potash from 90 per cent. sulphate which contains 48.60 per cent. of actual potash.

$$200 \div 0.4860 = 411 \text{ pounds.}$$

Now we have the required quantities for our mixture which stands thus :—

Nitrate soda,	379	pounds
Dried blood,	570	"
Dissolved bone-black,	588	"
Sulphate potash (90 per cent.),	411	"
Total.	1948	"

But the aggregate number of pounds falls short of one ton (2000 pounds). We may make up this deficiency by adding 52 pounds of sand, land plaster, or other materials, or we may slightly increase the quantities without materially altering the ratios of fertilizing constituents.

Suppose we take—

Nitrate soda,	380	pounds
Dried blood,	575	"
Dissolved bone-black,	625	"
Sulphate potash, (90 per cent.),	420	"
Total,	2000	"

Now let us tabulate results :—

POUNDS.	MATERIALS.	NITROGEN.	PHOSPHORIC ACID.			POTASH.
			Avail- able.	Insol- uble.	Total.	
380	Nitrate Soda,	lbs. 60.07	lbs.	lbs.	lbs.	lbs.
575	Dried Blood,	60.37	. . . . .	. . . . .	10.98	. . . . .
625	Dissolved Bone-black, . . . . .	. . . . .	104.37	1.87	106.24	. . . . .
420	Sulphate Potash (90 per cent.),	. . . . .	. . . . .	. . . . .	. . . . .	204.12
2000	Total quantities in one ton,	120.44	104.37	1.87	117.22	204.12
	Per cent.,	6.00	5.21	0.09	5.86	10.20

The approximate cost of these materials in such trade centers as New York and Philadelphia can be made by allowing $14\frac{1}{2}$ cents per pound for nitrogen in nitrate of soda, $18\frac{1}{2}$ cents per pound for nitrogen in dried blood, six cents per pound for available, and two cents per pound for insoluble phosphoric acid, and five cents per pound for potash in 90 per cent. sulphate. Thus we have—

60.07	pounds nitrogen from nitrate of soda at $14\frac{1}{2}$	= \$ 8.71
60.37	" " " dried blood at $18\frac{1}{2}$	= 11.16
104.37	" available phosphoric acid at .06	= 6.26
12.85	" insoluble " " at .02	= .26
204.12	" potash from 90 per cent. sulphate at .05	= 10.20
		\$36.59

To this should be added the cost of freight and mixing. In the foregoing formula we have the nitrogen in nitric acid and organic nitrogen. In our next formula, which the writer has used with uniform success for potatoes, we have the nitrogen in the three forms of nitric acid, ammonia, and organic nitrogen.

Nitrate of soda,	260	pounds
Sulphate of ammonia,	200	"
Dried blood,	380	"
Dissolved bone-black,	300	"
Dissolved S. C. rock,	420	"
Muriate of potash (80 per cent.),	200	"
Sulphate of potash (80 per cent.),	240	"
	2000	pounds

Now let us examine this mixture and see wherein it is especially adapted to potatoes.

POUNDS,	MATERIALS.	NITROGEN.	PHOSPHORIC ACID.			POTASH.
			Avail-able.	Insol-uble.	Total.	
260	Nitrate Soda,	41.10	lbs.	lbs.	lbs.	lbs.
200	Sulphate Ammonia,	41.00	• • •	• • •	• • •	• • •
380	Dried Blood,	39.90	• • •	7.25	7.25	• • •
300	Dissolved Bone-black,	• • •	50.10	90	51.00	• • •
420	Dissolved S. C. Rock,	• • •	50.50	13.44	63.94	• • •
200	Muriate Potash (80 per cent.),	• • •	• • •	• • •	• • •	101.04
240	Sulphate Potash (80 per cent.),	• • •	• • •	• • •	• • •	103.60
2000	Total quantities in one ton,	122.00	100.60	21.59	122.19	204.64
	Per cent.,	6.10	5.03	1.07	6.10	10.23

We perceive the formula contains nitric, ammoniac, and organic nitrogen in nearly equal proportions taken from three sources of supply. Our available phosphoric acid is evenly divided between dissolved bone-black and dissolved South Carolina rock; in addition to this we have 1.07 per cent. of insoluble phosphoric acid, making the total phosphoric acid 6.10 per cent., and the potash is divided between 80 per cent. muriate and 80 per cent. sulphate.

OTHER FERTILIZERS FOR POTATOES.

1.	Nitrate soda,	400 pounds.
	Sulphate ammonia,	300 "
	Dissolved bone-black,	600 "
	Sulphate potash (80 per cent.),	480 "
	Land plaster, sand, or loam,	220 "

Contains 6.22 per cent. nitrogen, 5.01 per cent. available phosphoric acid, and 10.36 per cent. potash.

On clover sod plowed under.

2.	Nitrate soda,	300 pounds.
	Dissolved S. C. rock,	1220 "
	Sulphate potash, (80 per cent.),	480 "
		2000 "

This mixture contains 2.37 per cent. of nitrogen, 7.32 per cent. available phosphoric acid, and 10.36 per cent. of potash.

3.	Farmyard manure,	10 tons.
	Nitrate of soda,	100 pounds.
	Sulphate of ammonia,	100 "
	Dissolved S. C. rock,	600 "
	Muriate of potash,	200 "

CHAPTER IV.

PLANTING.

The selection of seed is one of the most important steps in growing a crop of potatoes. I always prefer medium-sized tubers for seed. Very large potatoes are liable to produce a coarse, rough crop, while, on the other hand, small seed may be immature, and with it there is a tendency to deterioration. Always select as near as possible perfectly formed potatoes, free from disease.

In cutting the tubers, care should be taken to divide the eyes evenly and to bruise the seed as little as possible.

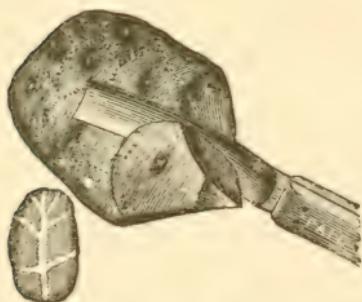


FIG. 2.

In case of scarcity, new, rare, or high-priced varieties, I always cut by hand, using a concave-curved knife with a very thin blade (Fig. 2); then take the tuber in the left hand, begin at the bottom or stem end and cut toward the center and down in the direction of the stem, following the growth of the germ, and taking but a single

eye. The tuber is then turned half way around, or to the opposite side, and the process repeated until the seed or blow end is reached, leaving to each eye enough of the tuber to sustain the plant until well rooted in the soil.

In ordinary field culture, where I have plenty of seed, the Aspinwall Potato Cutter is used with complete success.

This implement not only divides the eyes more evenly, but

leaves them in better shape for planting than the average hired help, and performs the work as fast as six or eight men can do it by hand. The only attention necessary is to be sure to place the seed end toward the person manipulating the machine. I have always had a perfect stand from seed cut in this way if properly planted.

After thirty-five years' experience in potato culture, and after having tried almost every conceivable experiment, both wise and otherwise, in seed selection and planting; having planted all the way from a single eye up to a whole potato: after having planted in hills and in drills and at various distances; after keeping minute records of successes

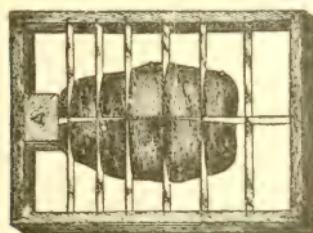


FIG. 3.

Aspinwall Potato Cutter.

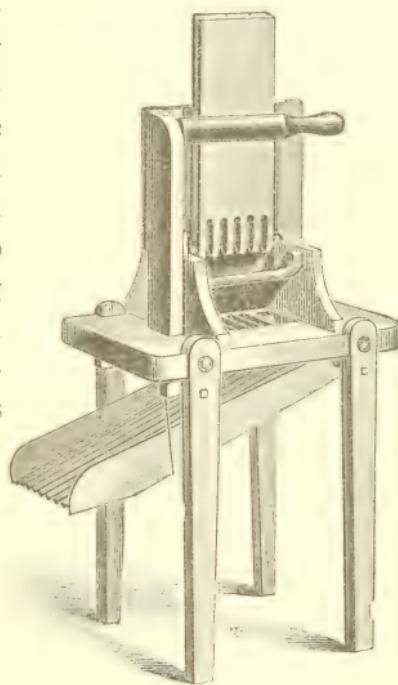


FIG. 4.

and failures, I am fully convinced that the average grower plants too much seed. I have almost invariably met with the largest share of success from the lightest plantings, not only in the weight of crop, but in the greater yield of marketable tubers as compared with the whole crop. Were it always possible without too much outlay of labor, I would invariably confine planting to a single eye to the hill; but when large areas are planted and the planter must be used, a two- or three-eyed

piece is best, since it insures a full stand with greater certainty.

Time of Planting.—This depends upon the variety and purpose for which the crop is planted. If for early market, we should choose the earliest and hardiest varieties, which should be planted in spring as soon as the land can be got into good condition. Planting should be somewhat shallow, so as to avoid rot in case of a cold, wet spell, and to afford ample time for growth before the hot, dry weather of summer. Potatoes delight in cool, moist weather.

If the crop is for seed alone, and is to be stored over winter, some varieties yield and keep better if planted later, so as to ripen during cool autumn weather, thus avoiding much shrinkage consequent upon lying in the ground during the dry hot time between ripening and storing crop. For the later or main crop I prefer putting off planting until about June 1st, as by doing so the work of fighting destructive insects is greatly lessened. With the pulverizer or harrow the larvæ of troublesome insects are so much more readily killed; with the larger tools of culture often ten or twenty acres being gone over in a day. Here in Iowa potatoes planted from the first to fifteenth of June make almost their entire growth of tubers during the cool, moist weather of fall, and are ready for harvesting almost as soon as growth is completed, thus insuring a larger and better crop of finer flavored potatoes with the least possible loss from shrinkage; and as they then make a more rapid and rugged growth are less liable to disease.

Distance Apart.—For the past fifteen years I have accepted three feet as the proper distance between rows. This gives ample space for the growth of tubers and for proper tillage, and leaves plenty of soil for hilling without running too deeply, thereby avoiding injury to the roots by cultivation.

With the latest improved tools, especially the Planet Jr. implements, the entire surface of the soil can be worked by

a single passage between rows, thus making one horse do the work usually done by two. There is ample space to destroy weeds should the crop from any cause become foul, and the rows are also near enough to each other to enable most varieties to cover and shade the ground during the later stages of growth.

This distance is also about right for machine digging, allowing each wheel of the digger to run in the furrow made in hillng. For over twenty years I have planted no other way than by drilling. I believe this mode gives each individual eye a better chance for growth.

Regarding the distance apart the seed is placed much depends upon the habit of growth of the variety to be planted ; if small and compact in growth, like the Early Six Weeks, Early Rose, Ohio Junior, or Puritan, much less room is required than with the spreading varieties. With the earlier varieties, 12 to 15 inches apart will be found about right, and with most varieties, such as Burpee's Extra Early or Beauty of Hebron, the latter distance will be found none too much.

For late varieties 15 to 18 inches, and sometimes 20 inches apart should be allowed. The quality and condition of the soil should also be taken into consideration ; a rich mellow soil free from weeds will, of course, be the best, and admit, other things being equal, of closer planting.

Depth of Planting.—This must also be gauged somewhat by the variety, time of planting, and habits of growth. Early varieties should be planted shallow. Early in the spring the ground is warmer near the surface, and the seed will be less liable to rot and will germinate more quickly. Most of the growth must be made during the cool, early spring months, before hot, dry summer weather comes. I have found a depth of about two inches right for early varieties, while with later ones, which must be kept thrifty during the long hot and dry spells of summer, a depth of from four to five inches is best.

Planting, since the advent of the Aspinwall Potato Planter, has changed from drudgery to pleasure. Now instead of two men and a team working hard all day to plant one or two

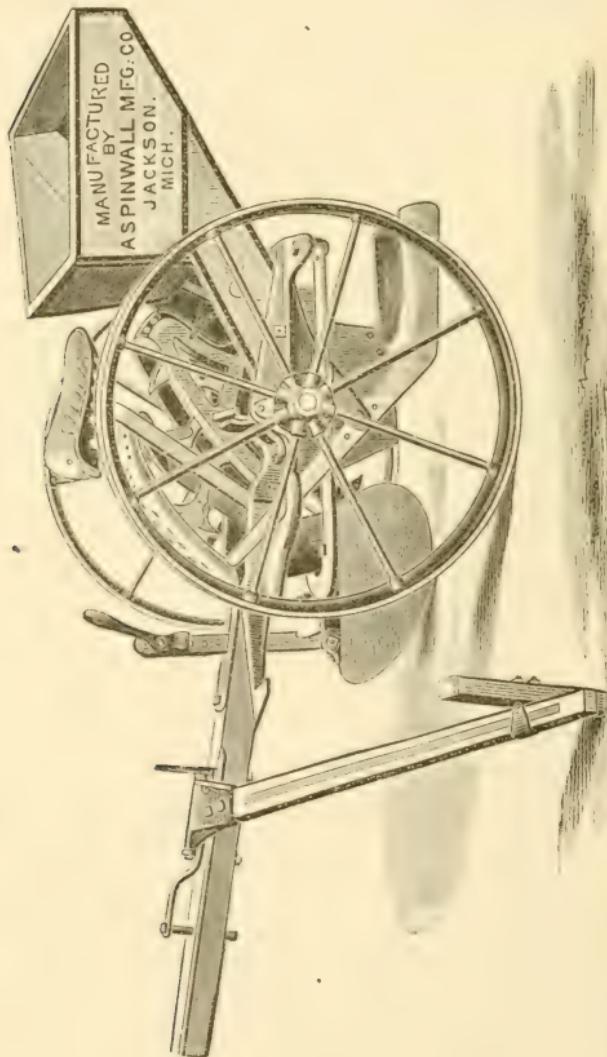


FIG. 5.—Aspinwall Potato Planter.

acres, one has but to adjust his pickers so as to drop at the proper distance, fill the hopper with seed and proceed with

the planting, easily going over from four to eight acres a day, making straighter rows than could be done in the old way, and dropping the seed at a uniform depth and distance apart. One great advantage over hand-planting is that the planter opens the furrow, drops the seed into fresh earth and immediately covers it without exposing seed or furrow to wind and sun. The only fault one can find with the Aspinwall Planter is that the seed-pieces have to be cut somewhat larger than for hand-planting ; but as a two- or three-eye piece is thus dropped, this is a trifling loss except where seed is very scarce and high, as is the case with the newer varieties. In such cases I take off the guard in front of the pickers, which are removed, place a tube from the shoe to the level with the seat, fasten a box for seed in front, and then put on a boy to drive, placing a temporary seat over the hopper. But one can drop through the tube by hand, the machine opening the furrow and covering the seed the same as when doing its own dropping.

We are often asked the question, "Can you raise as large crops when put in with the planter as when planted by hand?" Our answer is, "Yes, only it takes a trifle more seed."

Many potato growers take an old corn planter, remove the box that holds the corn, and insert in its place tubes, either of wood or tin, somewhat enlarged at the top, and large enough to let the seed pass down easily.

Two lively boys are placed on a seat where the corn dropper formerly sat and, with their backs to each other, drop the seed evenly.

The small grower cannot always hire a planter, and his acreage will not warrant the purchase of such a machine. If the old way of planting is not the easiest, it is at least safe, and I often think the best in many respects, especially where we wish to improve old or develop new varieties. In such cases, as in all the operations of the farm, good tools are needed, for

while a common plow will do if nothing better is at hand,

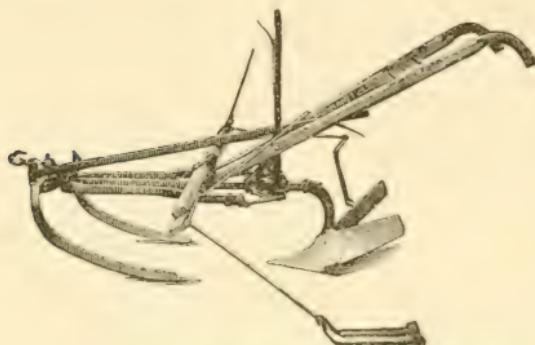


FIG. 6.—Planet Jr. Furrower, etc.

yet a Planet Jr. Furrower, Marker, Hiller, and Ridger combined, as shown in Fig. 6 for marking out, and as in Fig. 7 for covering, will be found very convenient. This new tool is shown in the illustrations. The

wings are adjustable from nearly perpendicular to nearly horizontal, or they may be removed entirely. The tool with lever runners moves steadily and is easily managed. The runners are adjustable both for depth and width. The marker is light and handy; it makes a wide, clear mark either on hard, dry ground or on new plowed land. For covering and ridging, the adjustable wing plows, shown in the cut (Fig. 7), or the ordinary side hoes are used. It is a capital hillier, and by taking off all the wings it hills less and works to fine advantage as a double plow.



FIG. 7.—Coverer and Ridger.

It has always seemed strange to me that the harrow is so little used by the average farmer in the early cultivation of growing crops, especially before the crop breaks through the ground. It is the exception rather than the rule to see the land touched with any tool for killing weeds until the crop is

several inches high. I have always found that the very best time to kill weeds is when they are young, in fact, before they get above the ground. Many a farmer waits until weeds have made considerable root growth, indeed, often approaching a sod, before starting the cultivator, and then he only kills one row at a time, while with a good team and light harrow he could have gone over from four to six times as much land.

CHAPTER V. CULTIVATION.

In a few days after planting we start cultivation, using a large twelve-foot lever harrow, setting the teeth but a trifle slanting at first, and give the ground a thorough harrowing. After a few days, simply waiting to let the weed seeds germinate, we go over with the harrow again, giving the teeth more slant so as to run shallow and not to break off the tender sprouts that may be coming up.

We often give three harrowings before the potatoes are fairly up, and as soon as they are two or three inches high go over the field again, keeping the harrow teeth perfectly clean and free from trash. Should the ground be inclined to bake, or if the weeds begin to grow, turn round and cross the field, and do not give up the work until the ground is perfectly level and the soil very fine. Don't be afraid of harrowing too much if you have a good harrow. There are many harrows now on the market, but a good lever harrow is so far superior to the old standing-tooth or smoothing harrow that we would have no other. The teeth of the smoothing harrow do not always need to be set at the same slant; where there is nothing to interfere we set the teeth pretty straight, and in that way can root up more weeds, but where there is anything in the way, in the shape of trash, we give the teeth more slant so as not to injure the young vines or to disturb the roots unduly in going over the field. The condition of the soil must guide us in finding the proper slant of the teeth. If the object is to smooth and pulverize, set the teeth very slanting.

In our work we have found the lever harrow represented in Fig. 8 about the best shape for use and wear, and at the same time it is durable and light. If there are no stalks or other trash to interfere, I begin cultivation with a Planet Jr. Twelve-tooth Cultivator with Pulverizer (Fig. 9). The blades of this implement are an inch wide, and are of such shape as to work in the most thoroughly satisfactory manner, and to offer an unusual amount of wearing surface. The recurved throat of the tooth and the high frame prevent clogging. The reverse position is quickly given to the teeth by changing a single bolt in each; the frame is heavy and strong.

I set this implement wide so as to run as near as possible to the rows, and follow the cultivator with an Improved Zephaniah Breed Weeder (Fig. 10), using the eight-foot size, which with the horse walking between rows takes two rows at once. This thoroughly loosens the ground around the hills, turning and rooting out all young grass and weeds that may have started. Three or four cultivations, always followed with the weeder, will keep the ground perfectly clean and very loose and mellow around the hills. This culture encour-

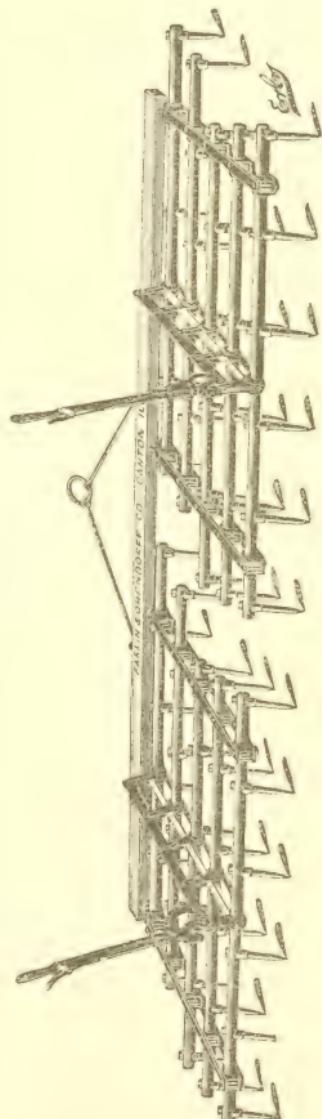


FIG. 8.—Lever Harrow.

ages a rapid growth, entirely dispensing with the use of the hoe.

If at any time the ground becomes foul or hard, I take a

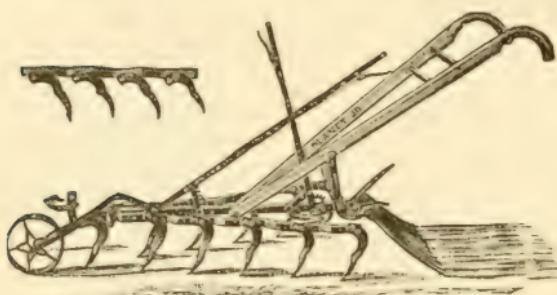


FIG. 9.—Planet Jr. Twelve-tooth Harrow, Cultivator, and Pulverizer.

Planet Jr. Horse Hoe (Fig. 11), using first $2\frac{1}{2}$ -inch shovels for front and outside rear standard, and three-inch shovels on central rear standard. Set the wheel, which is easily adjusted by

a lever, so as to run only deep enough to thoroughly break up the crust, loosening the soil and turning up the weeds. By holding the tool perfectly level so that all the shovels take the same depth, the rear shovels, if set at proper width,



FIG. 10.—Improved Zephaniah Breed Weeder.

will throw considerable dirt into the potato row; following with the weeder, that all weeds in the row may be killed and ground loosened around the haulms. I always try to give my potatoes, whether weedy or not, at least four cultiva-

tions and at least three with the weeder, but always work the crop as shallow as is possible consistent with thorough pul-

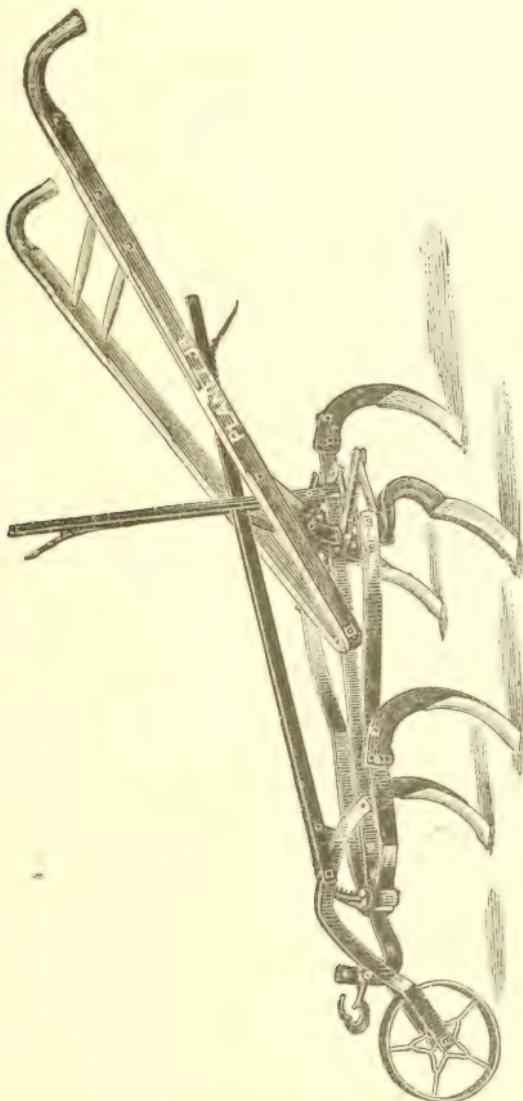


FIG. II.—*Planet Jr. Horse Hoe.*

verization of the soil and with the complete destruction of weeds. If this work is done properly the ground must be in good condition, and the tops covering the ground in the rows

will extend well out toward the center of the intervening space between the rows.

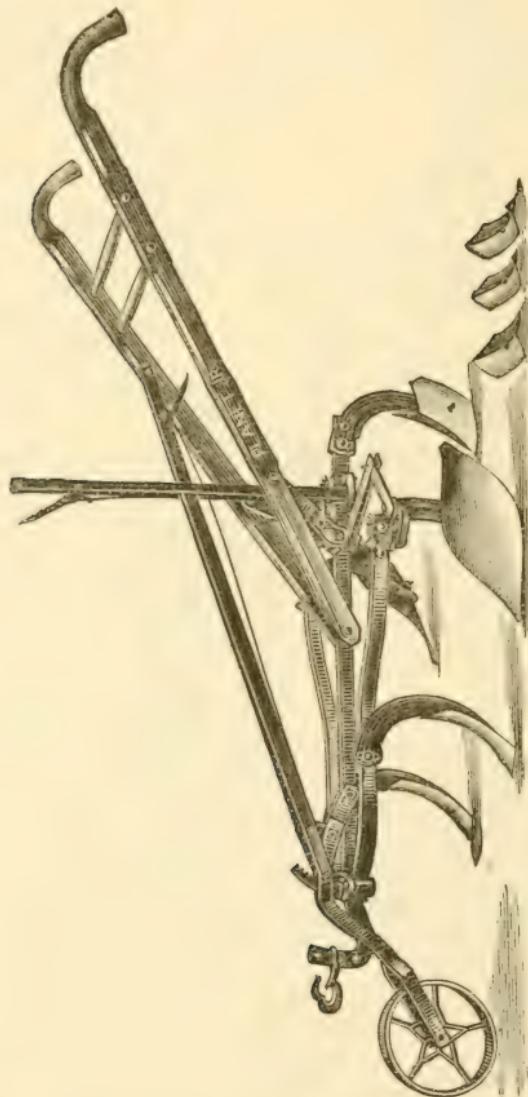


FIG. 12.—*Planet Jr. Horse Hoe with Hiller.*

I now change my tactics by taking off the three rear steels of my horse hoe and putting on in their place two hillers, turning the standards so as to throw the dirt toward the row;

now place an eight-inch shovel on the rear standard and you have the tool set for hilling (Fig. 12). You will notice that the outside steels or hillers run very shallow on the outside near the row, scarcely half an inch deep, the inside ones only from $1\frac{1}{4}$ to two inches deep, while the central shovel at the rear follows at a trifle greater depth, thus moving the dirt from the center of the row toward the potatoes, and slightly lifting the earth places it around the haulms without bruising or covering any of the leaves. If the work is properly done you now have a perfectly clear field with a broad, low hill, which has been made without disturbing the roots, enabling the tubers to make a sturdy, rapid growth without check. The drier the season and the shallower the cultivation the oftener should the soil be stirred. Do not let the ground get hard or give the weeds a chance, but keep the earth loose and mellow.

No crop responds more readily to timely, well-directed labor than the potato, and none suffers more from neglect.

CHAPTER VI.

INSECT ENEMIES.

The chief insect depredator with which the potato grower has to contend is the familiar Colorado Potato Beetle (*Doryphora decemlineata*). There are, however, several other insects, which at times and in some parts of the United States prove quite destructive to potatoes. Among these are the Potato or Tomato Worm, several species of Blister-Beetles, the Potato Stalk-Weevil, and the Imbricated Snout-Beetle.

The Colorado Potato Beetle (*Doryphora decemlineata*).—This insect needs no description here. The eggs, which are from a light yellow to deep orange color, are laid in varying numbers from 12 to 50, on the under side of the potato leaf, where they hatch in about one week into sluggish larvæ which feed upon the leaves. Paris green and London purple are used almost universally for combating this pest. These poisons may be applied in liquid suspension, or in powder diluted, one part of poison to 50 parts by weight of flour, sifted road dust, ashes, or with 100 parts of land plaster. The poison may be dusted over the foliage with a powder gun or perforated can, or in suspension may be applied with a hand- or horse-power spraying machine. In gardens or small patches the ordinary watering pot with a fine rose or a knapsack sprayer will prove efficient.

One of the most recent inventions is the Leggitt Dry Powder Gun, which seems to do the work of distribution fast and well over all parts of the plant. Many claim that a fast walking man can apply the powder to an acre in one hour without

undue exertion, and at the same time, it is claimed, the work is better done than with sifting or spraying appliances.

A new and important discovery announced during the present year is the use of arsenate of lead as an insecticide. The advantages of this poison over Paris green and London purple were first made known by Mr. F. C. Moulton, of the Massachusetts Gipsy Moth Commission. This insecticide promises to be especially useful in treating the foliage of the potato as



FIG. 13.—Colorado Potato-Beetle. *a, a.* Eggs. *b, b.* Larvæ. *c.* Pupa. *d, d.* Beetles. *e.* Wing of beetle, magnified. (Riley.)

well as that of more tender plants, since it lacks the caustic action of Paris green and London purple.

The preparation was made by dissolving 11 ounces of acetate of lead and four ounces of arsenate of soda in 150 gallons of water.

These substances quickly dissolve and one of the chemical compounds formed is arsenate of lead, which is a fine, white powder, lighter than Paris green and fully as effective in

destroying insect life. But it is preferable to Paris green for other reasons; if by any means the mixture happens to be used stronger than is necessary, even though three or four times the strength required to kill insects, it does not injure the foliage of plants. Frequently in using Paris green on potatoes much injury results from the poison burning the foliage. The liability of using too much, or of the poison not being well held in suspension, is one great objection to the use of Paris green. Arsenate of lead is a much lighter poison and does not settle so readily, and consequently can be distributed more evenly over foliage; with it this danger is practically reduced to nothing.

Professor C. H. Fernald, of the Hatch (Mass.) Experiment Station, advises that two quarts of glucose, or if it cannot be obtained, then two quarts of cheap molasses be added to each 150 gallons of water used. He says of experiments in 1893: "This insecticide will remain upon foliage for a long time, even after heavy rains."

Acetate of lead and arsenate of soda are both poisons, and in handling them the same caution should be exercised as is taken with Paris green and other arsenical compounds.

The Potato or Tomato Worm (*Phlegethontius celeus*).—The parent of this pest is a beautiful sphinx moth nearly related to the Carolina Tobacco Sphinx (*Phlegethontius carolina*). This insect is of northern distribution, and is perhaps more destructive to the tomato than the potato. It is the tobacco worm of northern latitudes, and was formerly confounded with its southern relative, *Phlegethontius carolina*.

Both moths have orange-colored spots on the sides of the abdomen, but in the wing markings there are perceptible differences. In the present species the general color of the body and wings in the adult is grayish, marked by stripes and dots in graduated shades of grayish brown, with a faint white spot near the center of each front wing.

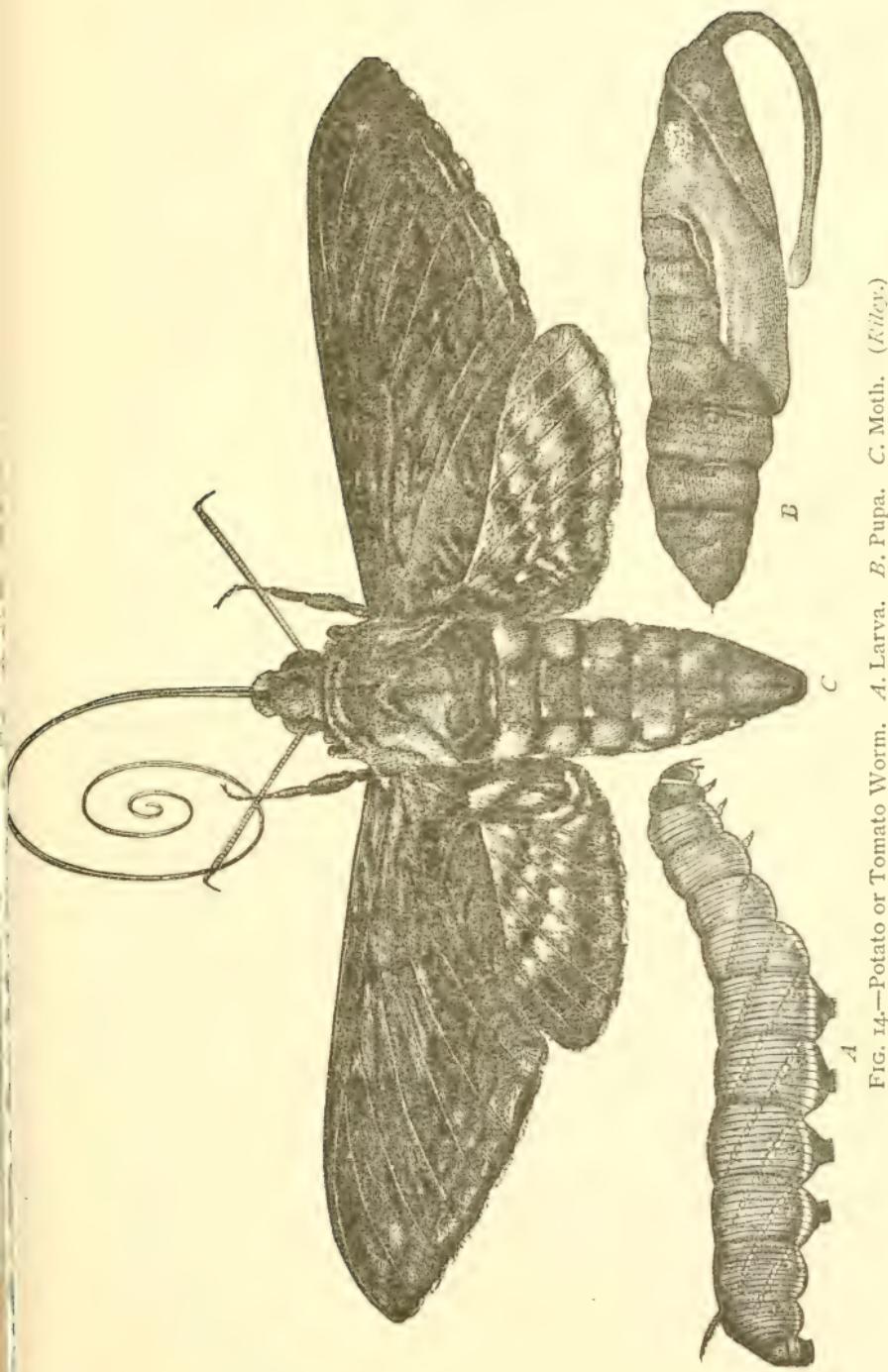


FIG. 14.—Potato or Tomato Worm. A. Larva. B. Pupa. C. Moth. (Kiley.)

The moths fly about dusk, lapping up the nectar of flowers through their long, slender sucking tubes or tongues. The adults appear early in the summer, and the females lay their eggs in the evening on the leaves of the potato and tomato.

The worm or caterpillar is a voracious feeder and soon makes its presence known by stripping the stems of foliage and by the abundant castings on the ground below.

The caterpillars grow rapidly and in a few weeks are about three inches long and of the thickness of a man's little finger. Their color is light green or brown, with oblique, whitish stripes on the sides of the body. When full grown, which, in the Northern States, is early in September, the caterpillars retire to the earth, where they make oval cells some distance below the surface and transform to pupæ, in which condition they remain until the following summer, when they come forth as moths.

The caterpillar is subject to the attacks of a small parasitic, four-winged, black fly, which deposits its eggs within the worm. These eggs hatch into little maggots which feed upon the juices of the body, developing at the expense of the worm. Caterpillars infested by this parasite may be readily known by their emaciated appearance and the little, egg-shaped cocoons of white silk which the larvæ spin upon the back of their hosts and in which the pupal period of the parasite is passed. Such caterpillars should never be destroyed, for, although they linger for some time, they will do but little harm and will never complete their transformations. The little flies will soon emerge and continue the work of destroying the noxious species.

Remedies.—In potato fields, one of the best ways of killing the moths is to take shingles or old pieces of tin and nail them to strips of wood, which are driven into the ground as supports. The pieces of tin or shingles should be supported from one to two feet from the surface, and smeared with

molasses mixed with a little poisoned water to which some whisky or malt liquor has been added. The damages done by the potato or tomato worm are by no means so formidable as formerly. The universal use of poison on the foliage in combating the Colorado beetle has not been without effect in reducing the depredations of this and other leaf-eating insects.

Blister-Beetles (*Meloidae*).—Several species of beetles belonging to the same family as the Spanish fly of commerce attack the potato. Among these are the *Striped Blister-Beetle*, the *Ash-gray Blister-Beetle*, the *Black-rat Blister-Beetle*, the *Black Blister-Beetle*, the *Margined Blister-Beetle*, the *White Blister-Beetle*, and the *Spotted Blister-Beetle*.



FIG. 15.—Striped Blister-Beetle.
(Riley.)

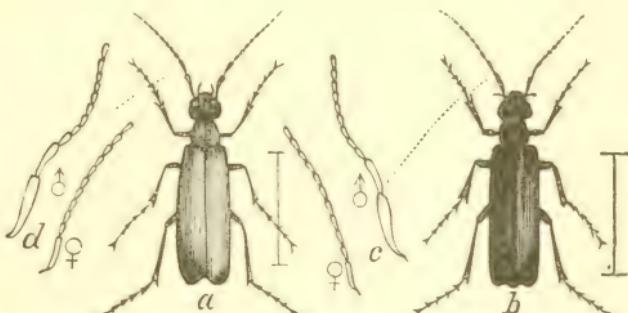


FIG. 16.—Gray (a) and Black-Rat (b) Blister-Beetles,
with the Antennæ Enlarged. (Riley.)

The Striped Blister-Beetle (*Epicauta vittata*).—It is in the adult stage that this insect feeds upon the leaves of the potato and occasionally on the foliage of the tomato. It has a slender body, marked on the wing cases with black stripes alternating with slender lines of yellowish brown. The eggs are laid in masses in the ground near the surface; the larvæ hatch in about ten days, and at once begin to burrow through the soil in search of the eggs of grasshoppers, upon which they feed. Dr. Riley says this species prefers most other kinds of potato tops to the Peach Blow.

The Ash-Gray Blister-Beetle (*Lytta cinerea*).—Dr.

Riley says of this insect: "It attacks not only the potato vine, but also the honey locust, and especially the English Windsor bean, and I have also found it quite abundant on early snap beans. It is very injurious to lucerne, also attacks the foliage of the apple tree, and likewise gnaws into the young fruit." It is of a uniform ash-gray color, and is the species commonly found in the more northern parts of the Northern States, where it takes the place of the striped species.

The Black-Rat Blister-Beetle (*Lytta murina*); the Black Blister-Beetle (*Lytta atrata*); the Margined Blister-Beetle (*Lytta marginata*); the White Blister-Beetle (*Lytta albida*); and the Spotted Blister-Beetle (*Lytta maculata*), all at times prove destructive to the potato.

Remedies.—These insects are not readily destroyed by Paris green, and it is questionable if insects so destructive to more injurious species should be molested unless their presence seriously threatens a crop.

"In the extensive beet fields of the West," says Dr. Riley, "it is the custom, when these insects are abundant, to send men or boys through the field, working with the wind, and

driving the beetles before them by short flights. On the leeward side of the field, windrows of hay or straw have been previously placed, and into these the beetles are driven and then burned."



FIG. 17.—Imbricated Snout-beetle. (Comstock.)

The Imbricated Snout Beetle (*Epicaerus imbricatus*).—A small silvery-white beetle with distinct markings on the back. This species feeds on the stems and foliage of many vegetables, including potatoes, beets, radishes, onions, beans, and corn. It also attacks the fruit and foliage of the apple, cherry, and gooseberry. When alarmed the beetles feign death.

Remedies.—The usual treatment for the Colorado Potato

Beetle, either in powder or liquid suspension, will be found fully efficient in destroying this pest.

The Potato-Stalk Weevil (*Trichobaris trinotata*).—It is in the larval stage that this insect is often most destructive to potatoes. According to Professor Gillette, 75 per cent. of the crop in 1890 was infested by this insect in Iowa.

The parent is a small snout-beetle of wide geographical distribution throughout the United States.

The female places a single egg in a slit about an eighth of an inch long, made in a stalk near the ground.

The eggs soon hatch into small, yellowish-white or whitish grubs, that tunnel into the heart of the stalks, burrowing downward toward the roots and causing plants to wither and the premature death of the vines.

When fully grown the grubs are a little over one-fourth of an inch long, yellowish-white in color, legless, and the heads have a scaly appearance.

In a few weeks the grubs pupate within the stalk below the surface of the soil, and emerge as ash-gray or bluish beetles late in summer or early in autumn.

Remedies.—Poisons are of little avail against the Potato-stalk Weevil. Whenever the presence of the larvae is indicated by the wilting and dying of the vines, they should be pulled up and burned. Even after harvesting the late crop the vines should be burned if the insect has been at work in the field.

CHAPTER VII. FUNGOUS DISEASES.

Potato Scab (*Oöspora scabies*).—This disease has been attributed to many causes, such as mechanical irritation, attacks of insects, excessive moisture, chemical erosion, etc.; but the careful researches of Dr. Thaxter and Professor Bolley seem to have settled conclusively the fact that the disease is directly due to the development of fungi upon the tuber. The patches of thick, brown, cork-like scabs are produced by the efforts of the tuber to heal the wound produced by the disease.

The fungus is identical with that which produces *Beet Scab*; since the land becomes infected, neither of these crops when diseased should succeed each other.

The spores appear to remain for several years in the soil without losing their vitality, and potatoes grown with farm-yard manure are more liable to be infected. The infection of the manure is unquestionably very generally due to feeding stock upon diseased potatoes or beets.

Treatment.—Under most conditions potato scab can be very easily controlled. Professor Bolley, whose careful researches have been alluded to, says: “There is no substantial evidence that any soil of whatever kind can in itself give origin to the disease. That certain characters in the soil may increase the capabilities of the disease to work damage, is possible. This point, however, is not proved, and even if it were, it need not militate against the use of any particular kind of soil, if care is taken to avoid the first cause, the plant parasite. The same argument holds for the use of manures, though it is

possible that barnyard manure may become contaminated from refuse matter containing the disease, and thus become a source of infection."

And Dr. Thaxter says: "The practice of feeding scabby tubers to stock is one of the most important means by which the disease is spread on farms. In view of the well-known fact that great numbers of fungous spores can and do pass through the digestive tract without injury, and that the scab fungus is known to grow luxuriantly in decoctions of horse or cow dung, it is not unreasonable to assume that its spores, passing through the digestive tracts of stock fed with diseased potatoes, continue their development after evacuation."

For the purpose of investigating the comparative merits of fungicides in treating this disease, the New York Experiment Station (Bull. 49, January, 1893) made trials with the following preparations:—

- (a) Copper sulphate (blue stone or blue vitriol).
- (b) Iron sulphate (copperas).
- (c) Zinc sulphate (white vitriol).
- (d) Eau celeste.
- (e) Bordeaux mixture.
- (f) Mercuric bichloride (corrosive sublimate).
- (g) Ammoniacal solution of copper.

The best results were obtained from the use of iron sulphate, zinc sulphate, and mercuric bichloride. The formula for either the iron sulphate or zinc sulphate is one ounce of sulphate to one gallon of water.

The mercuric bichloride formula is: "Dissolve two ounces of corrosive sublimate in two gallons of hot water. Let stand several hours, or over night, and then dilute to 15 gallons."

Corrosive sublimate is a very dangerous poison. All seed treated with the poisonous solution should be planted, or if any is left over, buried beyond the reach of farm animals.

For treating small quantities of seed, barrels or tubs will

suffice. For large quantities a narrow box or trough is best. After treatment the tubers may be removed from the solution with a wooden potato fork. Soak all seed for one and one-half hours ; this may be done either before or after cutting the seed pieces ; the writer prefers to do the cutting after subjecting the tubers to treatment. After soaking one and one-half bushels of potatoes to each two gallons of solution, about three-fourths of the original amount of corrosive sublimate should be added, as well as enough water to replace what has been lost in removing the treated tubers. Wooden vessels that have contained the poisonous solution can be cleansed by thoroughly washing with clean water, and then with water containing a little sal soda.

In using either iron sulphate or zinc sulphate in solution, wooden vessels only should be used.

Blight and Potato Rot.—There are probably several maladies to which the potato is subject, which are known as “*Blight*” and “*Rot*.[”]

The Leaf-Spot Disease or Early Blight (*Macrosporium solani*) appears early in the season as small brown spots or patches scattered over the foliage. The plants change to a pale green or yellowish color, and die before completing their growth. The tubers do not appear to be subject to the infection, but owing to the early death of the vines never attain maturity.

The Late Blight or Downy Mildew (*Phytophthora infestans*).—The first appearance of this fungous disease is made apparent by the premature wilting of the tops. The color of the foliage changes first to a sickly yellow and then to a dirty brown ; on the under side of affected leaves is formed a delicate, whitish growth resembling mildew.

“The disease,” says Dr. Roland Thaxter, “spreads quickly, inducing a very rapid and characteristic decay in the plants, and if not checked, the fungus causing the decay makes its

way to the tubers and affects them, producing the well-known 'rot.'

The conditions which seem most favorable to the development of this malady are excessive rainfall, accompanied by an average temperature of below 75° Fahr.

Treatment.—There can be no doubt of the efficiency of Bordeaux mixture as a preventive of these diseases and possibly of others of bacterial origin. Bordeaux mixture should be used even though there be not the slightest appearance of blight.

The Colorado potato beetle must be fought with poison, and by combining the insecticide with Bordeaux mixture the cost of the fungicide is reduced to the mere cost of materials and mixing. The use of the combined insecticide and fungicide should begin at the first appearance of the potato beetle, and at least four sprayings should be made during the season of growth.

For the first two sprayings the New York Station (Bull. 49, 1893), recommends that the Bordeaux mixture be reduced to one-half the standard strength, and that the last two applications be of full strength. On the other hand, the U. S. Department of Agriculture obtained as good results with Bordeaux mixture of half strength as with that of full strength.

The New York Station estimated the cost of four sprayings at \$6.50 per acre. This estimate was based on labor at \$1.35 per day, the use of about 90 gallons of mixture to the acre, applied with a knapsack sprayer and Vermorel nozzle, and the treatment of two acres a day by one man. The increase in crop resulting from spraying was 40 bushels. The Rhode Island Station (Third Annual Report) increased the yield 48 per cent., and the Vermont Station (Bull. 24), in 1890, saved 79 bushels per acre over the unsprayed plots. The cost of spraying is variously estimated by others at from \$5.00 to \$10.00 per acre, but all experimenters are agreed that the

increase in cost due to the use of an insecticide combined with Bordeaux mixture is more than amply repaid in the yield of the crop; indeed, many believe that the Bordeaux mixture not only prevents rot, but has some obscure value as a fertilizer.

Bordeaux Mixture.—*First.* The following is the official formula for Bordeaux Mixture, published in Farmers' Bulletin, No. 7, U. S. Department of Agriculture:—

"In a barrel that will hold 45 gallons, dissolve six pounds of copper sulphate, using eight or ten gallons of water, or as much as may be necessary for the purpose. In a tub or half barrel slake four pounds of *fresh* lime. When completely slaked, add enough water to make a creamy whitewash. Pour this slowly into the barrel containing the copper sulphate solution, using a coarse gunny sack stretched over the head of the barrel for a strainer. Finally fill the barrel with water, stir thoroughly, and the mixture is ready for use. Prepared in this way the cost of one gallon of the mixture will not exceed one cent, the price of copper sulphate being seven cents per pound and lime 30 cents per bushel. In all cases it is desirable to use powdered copper sulphate, as it costs but little more and dissolves much more readily. It is highly important also that fresh lime be used."

By the addition of four ounces of Paris green or London purple to each 50 gallons of Bordeaux mixture, we have a most excellent insecticide and fungicide combined.

The writer also adds one quart of glucose or cheap molasses to each 50 gallons of mixture.

Second. A second mixture may be made which is cheaper and which the writer has found effective against potato "rot." It is made thus:—

Sulphate of copper (blue stone), four pounds; quicklime, four pounds; water, 80 gallons; add four ounces of Paris green or London purple and one quart of glucose or molasses to each 50 gallons of mixture.

"It is found," says Professor B. T. Galloway, "that much time is saved by preparing what may be called stock solution of both copper sulphate and lime milk. A stock solution of copper sulphate may be made by dissolving copper sulphate in water at the rate of two pounds to a gallon. The most convenient way to dissolve the copper sulphate is to tie it in a coarse sack and then suspend the same in a barrel in such a way that it will be as near the top as possible. The barrel is then filled with water, and the copper sulphate within the sack quickly dissolves, the solution sinking at once to the bottom and the fresh water coming to the top to take its place.

"If the copper sulphate is placed at the bottom of the barrel at once, the surrounding water soon becomes saturated with the chemical in solution, and in this condition, being heavier than the water alone, it remains at the bottom, and in consequence prevents the further action of the liquid above.

"If it is desired to make up a 50-gallon barrel of stock copper solution, 100 pounds of copper sulphate is weighed out, suspended in the sack within the barrel as already described, and the barrel is then filled to a 50-gallon mark previously made. As soon as the copper sulphate is dissolved, the sack should be removed and sufficient water added to bring the solution up to the desired quantity. A stock solution prepared in this way will last indefinitely, provided too much of the water is not allowed to evaporate.

"In preparing a stock milk of lime, slake 100 pounds of fresh lime after the fashion practiced by masons. When slaked place the paste in a 50-gallon barrel and then fill the latter with water.

"In preparing Bordeaux mixture from such stock solutions it is only necessary to take a given quantity of each and mix them together. Thus, if 50-gallon formula for Bordeaux mixture is adopted, it will be necessary to use three gallons of the stock solution of copper sulphate and approximately two

gallons of the stock lime preparation. The copper sulphate solution should first be placed in a barrel and then nearly enough water added to fill the latter. The lime milk should then be added and the whole thoroughly stirred. Before using, the mixture should be tested by the potassium ferrocyanide test; that is, a few drops of the solution of the latter chemical should be added, and if no change in color is noted the fungicide may be considered perfectly safe. In case a reddish precipitate forms when the potassium ferrocyanide is added, lime milk should be stirred in until no reaction takes place." ("Insect Life," No. 2, Vol. VII, page 127.)

To the farmer who may not be prepared to make the potassium ferrocyanide test, we suggest the use of a slight excess of the lime milk in preparing Bordeaux mixture from stock solutions of copper sulphate and milk of lime.

CHAPTER VIII.

HARVESTING.

No part of the work of potato growing is attended with so many difficulties. The time in which the crop must be secured, if secured at all, is often very limited, and the work must be pushed from the very start. A change in the weather, a very wet spell, may cause the loss of several days, often leaving the ground soggy; or a long dry spell may have so hardened the ground that it is lumpy and difficult to work; then there are sure to be little breaks and consequent delays for repairs of machinery,—in fact, a thousand-and-one little annoyances are liable to confront us just as they do in harvesting grain or in haying.

The scarcity of really good machinery for doing the work is another great drawback in harvesting potatoes. For the many hindrances and delays, for all the emergencies liable to happen, we must be ever ready with expedients for overcoming difficulties and accomplishing our work.

If you intend to grow potatoes for profit you must have a good potato digger, one that is large enough and strong enough to do the work required. If I could sell my experience with potato diggers and potato digger agents and manufacturers for what it has cost me, I would think myself pretty well to do. I have tried walking diggers and riding diggers, elevating diggers and shaking diggers, one-, two-, and four-horse diggers, and at times I have felt that I would have to go back to the old-fashioned hand-fork, or plow them in the old-fashioned way. And yet there are good, strongly made potato

diggers that do the work well. With whatever machine you choose, the work of digging may be expedited by careful preparation. Should the land be foul with weeds or grass, or should there be a heavy growth of vines, these should be removed before digging is begun. The digging can always be done better if the trash is first removed. The removal of the encumbering vines, trash, etc., can best be accomplished with a mower and horse rake. If the rows are three feet apart, a five-foot machine will cut two rows at a swath, and if the rubbish is dry, rake it into windrows and burn, or, if not too cumbersome, rake into bunches and leave until the potatoes are dry.

If the ground has become hard it is best to run a slanting tooth harrow over the field, going lengthwise with the rows, thus breaking up the top crust, so that in running up over the digger much of the dirt will fall through and thus give the machine a better chance of separating the tubers from the soil. Now as to the machine used: considering the great differences in soils, the varying habits of growth with different varieties of potatoes, whether deep or shallow, scattering or close in the hill,—considering all the different circumstances that are liable to confront us, I am fully convinced that the Hoover Digger (see Fig. 18) is the best. I regard it as the best—

First, because it is the only potato digger that separates the trash from the tubers, carrying the trash to one side.

Second, because it leaves the potatoes in a narrower row entirely out of the way of the wheels or horses in digging the next row, and, I may add, making the picking up of the tubers much easier.

Third, because the Hoover digger separates the tubers from the soil by a forward and backward sliding motion, thus allowing the tubers to slide off without bruising, instead of tossing them up as other diggers do.

Fourth, this digger is strongly and honestly made, of the

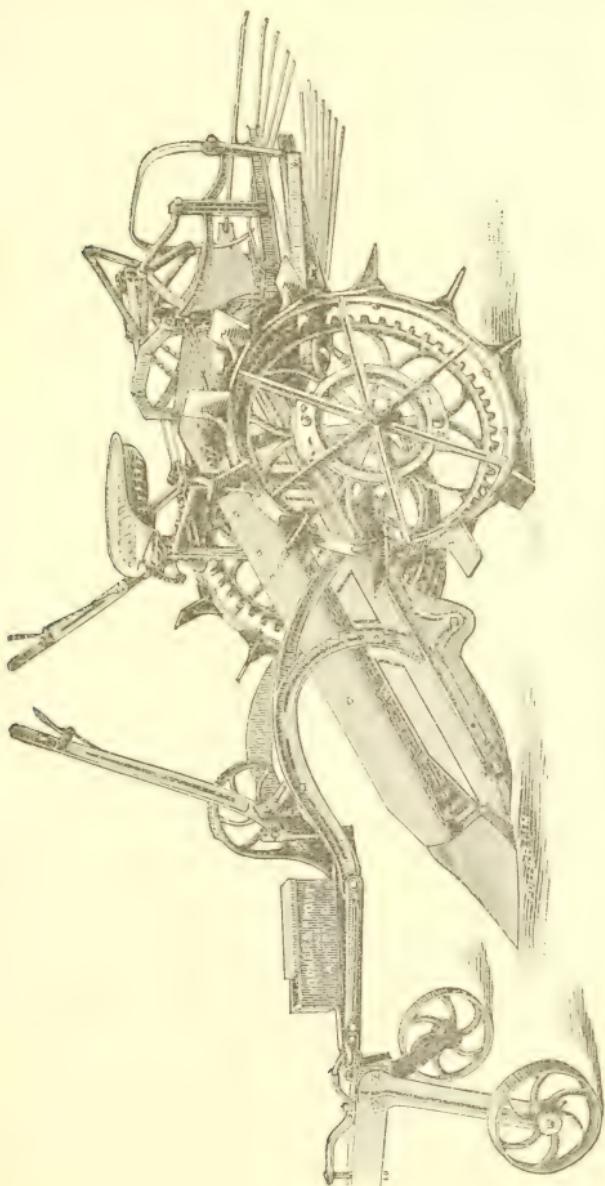


FIG. 18.—Hoover Potato Digger.

best materials. This is especially important with a potato digger, for if the season be a dry one and the ground is hard,

the tubers are likely to be deeply set in the ground. The digger will be required to withstand a severe strain, and if it be a light, flimsy machine it may break down and cause much delay, and possibly the loss of a part of the crop.

Fifth, having no cogs to wear or break, and being lower geared than many other machines, with the wearing parts well covered to exclude dirt and sand, I believe it to be a longer-lived machine than most others.

Now, having your land prepared and trash removed, your digger ready, well oiled and all nuts tight, and a full complement of diggers, wagons, horses, and teamsters, you are ready for business.

Do not try to work with an inadequate force. In digging I always use four good horses, hitching them to the machine four abreast.

The distance the potatoes have to be hauled will, to a large extent, determine the number of teams to be used ; but if you intend to do a day's digging, have at least two teams for hauling. In digging any of the tougher-skinned varieties, especially if for market, I prefer to have the potatoes picked right into baskets and dumped directly into the wagon, rather than to sack them in the field, or to handle, as many do, in boxes. Have the teamsters to drive along as close as possible to the edge of the rows and to keep up with the pickers, carefully dumping the baskets into the wagon as they are handed up by the pickers. Most of my picking is done by boys. At this time of year it is often hard to get enough good men, and a strong, active boy will often do faster and better work than a man. Always have enough pickers to gather the potatoes nearly as fast as dry, so that, if the digger is stopped a short time before night, all the tubers can be easily secured before the usual time to stop work. Don't try to work too late ; by eight or ten hours of steady, well-directed work in the field you will accomplish more than by working over-time without

a judicious division of labor. I have found that most hands, and especially boys, appreciate one's efforts to make their work as light and agreeable as possible, and are sure to resent as an imposition all attempts to compel them to work over-hours, or to do more than they are able.

If the potatoes are to be stored, we always haul and shovel directly into the pit or cellar, using a potato or coke-scoop shovel. (Fig. 19.)

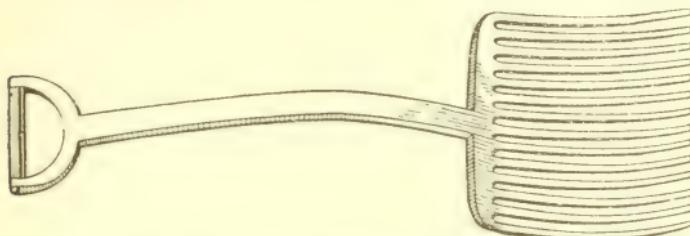


FIG. 19.—Potato or Coke-scoop Shovel.

If the potatoes are to be shipped, they are placed in a dark room and allowed to sweat before being sorted for shipment. In handling care should always be taken not to bruise the tubers. In case of the thin-skinned varieties, or choice ones grown specially for seed, it is best to pick directly into boxes or baskets and haul at once to the place of storage.

CHAPTER IX.

STORING AND MARKETING.

Before sorting potatoes, especially if they are to be shipped any great distance, I prefer that they be stored in a pile in a dark, cool place for a week or ten days, so that they may sweat. The skins are by this process toughened, and any dirt which may have adhered to the tubers after digging will be loosened and fall off. Besides, I believe there is much less danger of heating and loss if shipped during warm or wet weather than if freighted when first dug. If a tender-skinned variety, the crop should be sorted by hand, especially if intended for seed, carefully taking out any bruised, cut, or imperfect tubers, together with the small ones.

If the skin is of ordinary toughness, after having gone through the sweat, they can be run through a sorter. There are a number of these machines in the market. I have found the Hoover (see Fig. 20) as good if not better than any other.

Set the sorter with the hopper near enough the pile of potatoes for convenient shoveling. Place a basket at the end for the large tubers and another directly under the machine to catch the smaller ones, or boards may be fastened to the legs and the potatoes shoveled away as rapidly as they accumulate.

Now, with a smart man to shovel and a boy to turn the crank, and another lively boy to change and empty baskets, one can easily sort a car of potatoes a day. If free from scab or cut potatoes, this will be force enough, but if the crop is infected with scab or has been cut much in harvesting, a good

man should be placed at the rear of the sorter to throw out all objectionable tubers.

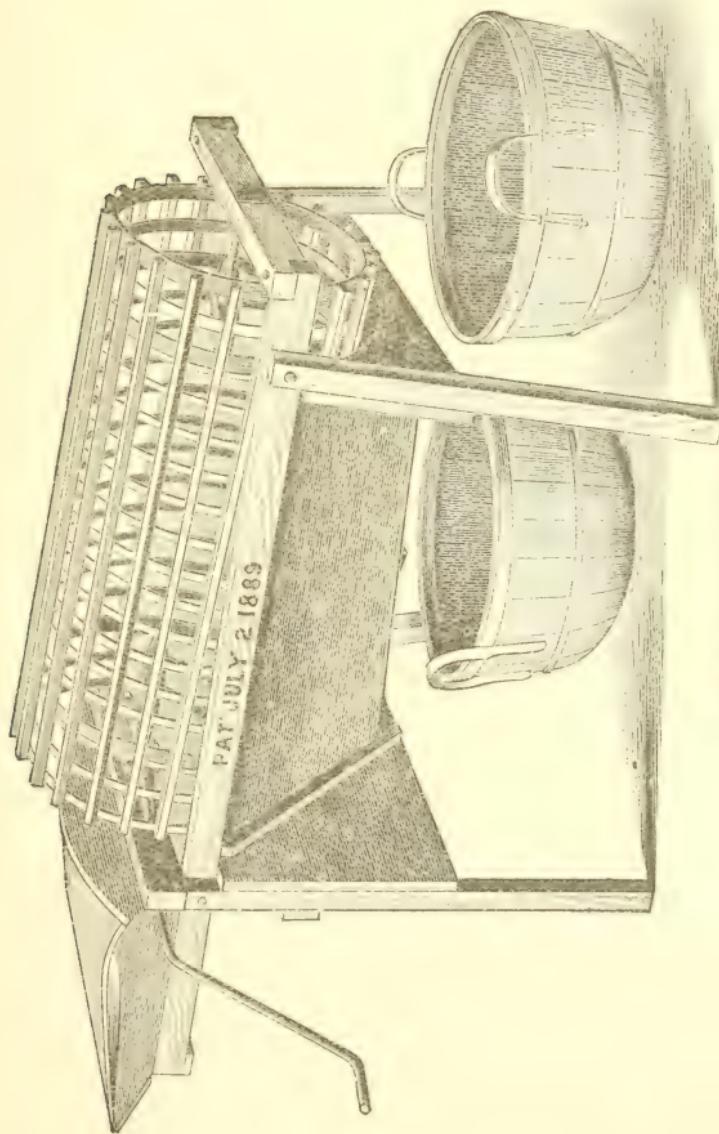


FIG. 20.—Hoover Potato Sorter.

When our crop is large or the potatoes are to be shipped for the general market, we set the sorter in the door of the build-

ing or storage room and have the potatoes shoveled into the hopper directly from the wagon that brings them from the field. If the potatoes are to be shipped any great distance they should be shoveled into barrels or bags.

For whole car lots I prefer to use bags, as they are much easier to handle than barrels, and pack so much better in the car. Again, if the weather is warm or damp the tubers are not so liable to heat. The bags should be filled perfectly full and then sown up tightly. In shipping long distances, I prefer a large thick bag holding from four to five bushels. These larger sacks save considerable time in sewing as well as in loading wagons and cars. With a good store truck and plank runway from the store-room to the wagon, men of ordinary strength can easily wheel the sacks to the wagon and from the wagon to the car. In loading a car begin at one end and pack the bags as closely together as possible. Fill to the door and then commence at the other end of the car and proceed as before until the entire space is tightly filled, so that the bags will not move about or be disturbed by the motion of the car. If care is thus taken in loading a car, the potatoes may be transported long distances without injury.

If to be sent to any particular market inquiries should be made as to the size and shape of the packages to be used. Different markets demand different packages. The sack most generally used is one holding 180 pounds, but some markets prefer 100 pound sacks.

If the potatoes are to go but a short distance they can be shipped in bulk. I often so ship the greater part of the crop, sometimes drawing it directly from the field, having the sorter in the car where the work of separating the marketable tubers from the small ones is readily done. By far the larger part of the crop grown in the West is so drawn directly from the field to the cars; or the tubers are placed in piles, and covered with straw until drawn to the cars.

If possible a dry or moderately dry time should be chosen for harvesting. But if the season is damp the tubers should be allowed to lie on the ground for a few hours, exposed to the wind and sun.

Winter Storage.—Much labor may be saved in storing away the potato crop if we have provided a few cheap conveniences which the farmer can make himself.

The first and one of the most useful devices is the dumping gate, of which many good makes can be found in our western markets. It may be so arranged as to be let down from the top to nearly level with the bottom of the wagon bed, and should have sides six or eight inches wide to keep the tubers from rolling off sideways.

A good chute should also be provided. It should have sides four to six inches high and a slat bottom, the slats running lengthwise and being about two inches wide and from one-half to three-quarters of an inch apart, so that the dirt will run through; one end should be placed in the wagon and the other enter the cellar or pit at just such an angle as will allow the potatoes to roll gently down the incline. In this manner the rough-skinned varieties may be handled with a saving of much labor. But tender-skinned varieties should be carried down in baskets or bags. Before storing, the tubers should be sorted and all showing indications of disease thrown out.

Use every reasonable precaution to prevent bruising. I always keep pits open during the night as long as it can be safely done without danger of freezing, so as to keep the temperature low, that the potatoes may remain dormant.

Where merely temporary storage for one winter is wanted, a pit (Fig. 21), dug about three feet deep, five or six feet wide, and as long as is necessary to store the crop, will be found satisfactory. Make a ventilator for every 15 feet in length of pit by using a one-by-six inch fence board 16 feet long, sawn in two pieces, one nine feet and the other seven feet

long. Rip the seven-foot piece lengthwise, making strips three-by-one inch. Place these strips even at the top end and nail together. This leaves an air space of three by four inches, and the narrow strips coming only to within two feet of the bottom end, give a circulation of air all through the tubers; set these up in the pit before putting in any potatoes, resting the bottom end on the ground, so as to take all damp air from the bottom. Fill the pit to within six or eight inches of the top at sides and ends, rounding it up in the middle to

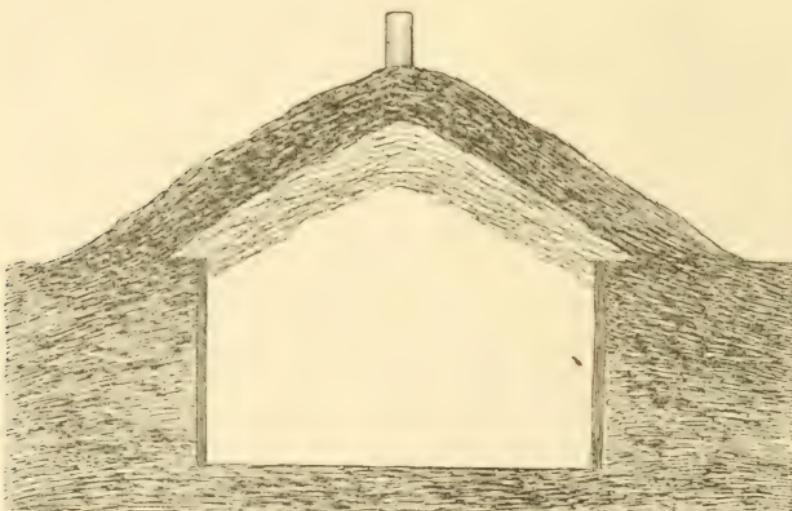


FIG. 21.—Cross-Section of Potato Pit.

one or two feet above the surface of the ground. Cover with at least two feet of good dry straw—wheat or rye preferred,—using care to have straw well tucked in at the sides and ends of the pit, so that, as the covering freezes and separates from the side, there will be no air space made. If care is used in covering, and the pit is not dug too deep or filled too near the top at the edges, I have always found the tubers to come out sound in the spring; but where pits of this kind have been made too deep, I have sometimes found a loss on

top resulting from the warm vapor rising from the bottom and freezing in the straw above; this thaws out in warm spells and causes rot. There will be no need at any time of closing the ventilator, as the damp air going out will freeze in cold weather on meeting the surface air, and in very cold weather close up the top, thawing out as soon as the weather moderates.

When large crops of potatoes or other root crops are regularly grown, a permanent pit or cellar will be found not only

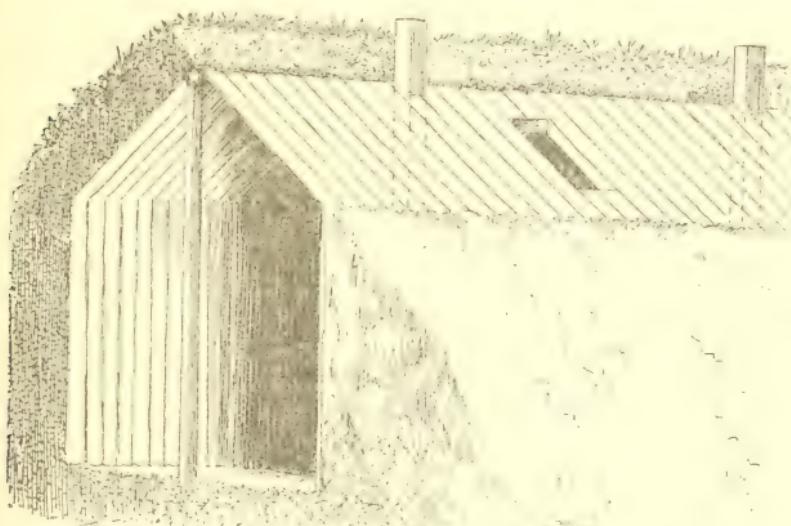


FIG. 22.—Permanent Potato Cellar.

the most satisfactory, but the cheapest. If possible, select a high, dry place to locate the pit, or else make it so by drainage. Excavate the pit by using a plow and road scraper, finishing up with a spade. I prefer a pit eight to ten feet wide and at least eight feet deep. It may be wider if many varieties are grown, so as to allow an alley-way along one side. Build it as long as is necessary to hold the crop. Dig a space at one end eight feet long and six feet wide for a hatchway, with steps or a ladder. Draw a line through center of pit lengthwise, and dig post-holes one-and-one-half feet deep and

large enough to take in a good post of cedar or other durable wood, eight inches in diameter and twelve feet long. Set these firmly in the holes and tamp well. Square and level the tops of these, which will extend three feet above the top of pit. Place the ridge-pole, which should be a strong timber, eight-by-ten inches, spiked securely to the tops of the center posts. Choose two two-by-twelve inch planks and lay them on the ground on each side of the pit at least six inches from the inside edge. For rafters or supports use fence posts placed several inches apart, fitted to the ridge-pole, and resting on the side planks. Spike firmly to the ridge-pole and side planks. Make frames two-by-six and three feet in depth with cleats inside at bottom for bottom cover. Use a tight-fitting cover for both the top and bottom. The top cover should extend over the edge one inch. Place these frames not over fifteen feet apart on one side of top for the convenient filling of the pit. Make ventilators four-by-six inches inside measure, and long enough to extend two feet above surface of covering and one foot below ridge-pole, and spike in place on one side of same. Now make another long enough to reach the bottom of pit and large enough to slip up over the one just described, but be sure to have the first four feet of the bottom quite full of two-inch auger holes, or else do not extend side boards to within one foot of bottom. On top of roof place cornstalks, sorghum bagasse, or other coarse material and on this spread two feet of soil. Sow the soil on top of pit with clover, to prevent washing. Make a hatchway with tight-fitting, inside and outside doors. Such a pit, if dug in good, dry soil, and if good material has been used, will last for years. If the soil on the sides should not be sufficiently strong to stand, the walls must be boarded. If too wet, cement must be used. I find that a pit constructed in this manner keeps the tubers firmer, and longer without sprouting, than where a solid plank or stone top is used.

CHAPTER X.

PROPAGATING NEW VARIETIES.

In propagating new varieties of potatoes or, in fact, of any plant, the one object should be improvement. There are enough worthless potatoes already, and every new one should mark an advance and be an improvement on our many excellent varieties.

Like produces like; a strong, vigorous parentage transmits a high degree of vitality to the offspring. On the other hand, weakness is the sure inheritance derived from a diseased or feeble ancestry. Says Professor Bailey: "Man must not only practice a judicious selection of parents from which the cross is to come, which is in reality the exercise of a choice, but he must eventually select the best from among the crosses in order to maintain a high degree of usefulness and to make any advancement."

We know that judicious crossing within the species, aided by careful selection of individuals between which the cross is to be made will improve the stock, but we must go a step further. The strongest, most vigorous parent will, to a greater extent, impress the offspring, whether it be the staminate or pistillate parent, with both its bad and good qualities.

With these facts before us let us go to work with a view to making improvement. Choose for both parents the very best specimens and trust nothing to chance. We sometimes see potato seed advertised for sale. In a few cases these offerings are from carefully selected specimens of choice varieties, and consequently the seed is very high in price. Most

of the seed offered, however, is simply taken from balls found growing in any field and upon any variety. Such seed is worthless. There can be no reasonable assurance of success unless you at least know the character of one of the parents. The only safety is in buying from responsible men who will truthfully tell you from what varieties seed has been grown, or you must grow the seed yourself.

Having decided to work for some special as well as real improvement, begin by pollinating the pistillate flowers with pollen from the staminate, using a fine camel's-hair pencil for the purpose, and being careful not to injure the tender organs of the plant. If this method is found too tedious let nature do its own work: simply select the tubers of the varieties from which you wish to save the seed. Plant them, and then on each side of the row from which you wish to save balls plant a row of the potatoes you wish to fertilize from. They will do their own fertilizing much more surely and cheaply than can be done by man; be sure that no other varieties are growing in the immediate vicinity.*

Saving the Seed.—As soon as the balls containing the seed begin to ripen or turn yellow, but before they fall, gather what you wish to preserve. Lay them on a board or paper for a few days and then squeeze the seed into a glass of water and wash thoroughly. Place in the sun for an hour or two to dry, after which keep in a dry, airy place for a few days, when the seed is ready to store away. Label plainly and keep in a dry place. Keep a record of the parent varieties.

* Many varieties which we have never known to bear seed will do so when planted beside others of robust growth. This has been the case with Burpee's Superior, which had never grown a ball until I planted it beside one of my seedlings of very robust habit of growth. The row next to the seedling was loaded with balls, the second row contained a few, and the other rows (24 in number) failed to produce a ball.

describing habits of growth, etc., so that in after years you may have a complete history of the experiment.

THE SEEDLING.

In early spring sow the seed in the hotbed or a box in the house and let the rows be two or three inches apart, and about half an inch deep. Use wood labels to mark the rows. Keep the ground moist, and in a few days the young plants will appear. Be sure to keep the bed moist and warm, but do not allow it to become overheated or the tender plants will be killed.

As soon as the plants are from an inch to an inch-and-a-half high, it is best to prick them out to other rows in the bed or to a cold frame, giving them more space so that they may become more stocky; it is also often well to prick out the second time, using small pasteboard boxes about four inches square, three inches deep and without bottoms. These can be set in a shallow box and filled with rich, mellow garden soil and placed in a cold frame until set out in the open ground.

Then select the richest and mellowest piece of ground in your garden, thoroughly pulverize the soil, mark off the rows far enough apart to be worked with a horse cultivator, setting the plants in the rows about 16 or 18 inches apart. Set the plants a little deeper at each transplanting, firm the soil with the hands or fingers, but do not press hard enough to cause the earth to pack or bake.

Some shade should be given the young plants for a few days after they have been set out. If grown in boxes as directed, they can be taken to the field for planting, and after marking out, holes may be made to receive the plants; then take each box as required for planting, and with a small, sharp knife-blade cut down the corners of the box which may be removed as the plant is placed in the ground. This is

readily done without disturbing the roots. Set a small stake at each plant, bearing a number, so that during the growing season a record of its habits of growth may be kept. Keep the ground well worked and free from weeds, drawing a little dirt to the plants at each hoeing. Early in the fall, before danger of freezing, secure as many small boxes as are required for storing the seedlings—either wood or pasteboard will do—and mark each box with the corresponding number of the hill from which the potatoes are taken. Store the boxes in a safe place in the cellar until the coming of spring.

At planting time prepare the land in the best possible manner, select for planting the best specimens of each box, placing a numbered stake firmly at the end of each row, or between the varieties in each row.

A record should be kept of the number of hills, habits of growth, together with any other data that may help in distinguishing each variety in case the stakes are lost or broken. But this should be carefully guarded against, and a missing stake should be immediately replaced. By all means begin the numbering from the same end of the rows.

The labor of the succeeding seasons is simply a repetition of the work described, each year selecting only the finest specimens of each variety and keeping a careful record of their habits of growth. This process of selection must be continued for five years before one is justified in introducing a distinct variety; and we have frequently continued the work of selection for six and seven years before being satisfied that a variety was worth introduction.

A few agricultural writers have claimed that three years were sufficient to develop and fix the type, but I want no three-year-old varieties. I have had hundreds of them to give every promise of making fine varieties until the fourth and even the fifth year, and then they would be found wanting in some essential characteristic, or would develop some fault that

would cause me to discard them altogether. Again, other varieties for the first three or four years may show scarcely a point in their favor. I now have in mind a potato that for three years was so extremely small that I only saved the tubers because they were very smooth and pretty, and when cooked were of excellent quality. This potato increased but little in size until the fifth year; suffice it to say it is to-day one of the heaviest cropping early potatoes in cultivation.

Propagators can plant but a few hills of each variety from year to year, or they would soon occupy too much ground. It has always been my plan to plant 20 to 40 hills each year, increasing the number to 200 or more of the most promising varieties. This is done to enable us to work up a stock of seed as soon as possible after ascertaining to a certainty that a new variety is worthy of introduction. From the very beginning all new varieties that show symptoms of disease, are rough or ill-shaped, should be discarded, and nothing but healthy, vigorous growers, smooth and well formed, should be retained. If one is to make a success in any branch of gardening or farming, he must cull with a bold hand. We cannot afford to waste time in propagating plants on anything but the best.

GROWING SEED POTATOES.

When the crop is to be grown for seed alone no labor nor care should be spared in selecting the stock seed, and in choosing and preparing the most suitable land. The preparation and after culture should be most thorough and complete. Only the choicest tubers from vigorous stock, grown under favorable circumstances, should be selected, and all small, rough, irregularly shaped seed should be rejected. Wherever possible, land should be selected where the crop has been free from disease for a number of years.

Cutting the Seed.—The seed should be cut carefully by

hand, using a knife with a sharp, thin blade,—a concave-bladed knife is best. (See Fig. 2, page 24.) I always prefer cutting to a single eye when growing for seed. By this division of the tuber there will not be so many potatoes set in the hill, but they will be larger, smoother, and finer in every respect, and consequently there will be a larger crop of merchantable potatoes.

If a tuber be cut lengthwise through the center with a sharp knife and then a thin slice be taken from either half, it will be observed, on holding the slice up to the light, that small, thread-like lines lead from the eye at the surface downward toward the center, where they unite with the main germ which passes through the tuber from the eye or blow end to the stem or end where the tuber has grown to the vine.

If a tuber be taken in the left hand and cut with a concave-bladed knife, commencing at the first eye at the bottom or stem-end and cut toward the center, and then down to the surface again, it will be observed that the slice contains the eye with all its thread-like connections or primary roots intact. All the eyes should be so cut. Simply revolve the tuber one-half way round and cut an eye at each turn until the seed or blow end is reached. Leave in each eye enough of the tuber to sustain the germ until well established in the ground. It should be remembered that the eye-pieces are not like seeds. There is no embryo to unfold. A potato is to be regarded as an underground branch, and the set or eye as a bud from which another plant is developed.

THE TRENCH SYSTEM.

I have only tried this method of planting on a limited scale and under rather unfavorable circumstances, yet it is my impression that this system requires too much labor and expense, both in planting and in harvesting the crop. Especially do I think this will be true where land is cheap and labor high.

With the small farmer and village gardener, anxious to make the most of what land he has, the trench system will grow in favor as it becomes better understood.

"The object," says Mr. E. S. Carman in the "New Potato Culture," "of the trench system in potato raising is twofold: first, to give a mellow, porous soil for the growing tubers. It is claimed that any considerable pressure upon them must have some effect to mar their shape and dwarf their size. The tuber takes no part in the nourishment of the plant, but must itself be nourished by the plant and its roots. If, therefore, when and after the tubers begin to form, the plants do not receive an abundance of food, their further growth must cease or at least be checked. But without moisture the food in the soil is unavailable, no matter how great soever may be the supply. Hence, therefore, second, the trench system, if maintained, retains moisture during periods of dry weather, when the soil as ordinarily treated would dry out." (See page 25 of the "New Potato Culture.")

This system consists simply in working the land deeply, and then forming trenches from six to ten inches deep. Mr. Carman, in his many experiments, obtained the largest yield in trenches four inches deep. The next best results were with trenches eight inches deep. He says: "When it is considered that the eight-inch trenches give the next largest yield, we have evidence that the experiments have not been carried on long enough to warrant any positive generalizations."

In this system the soil in the bottom of the trench is worked over and the fertilizer well worked in. The tubers are planted at the bottom of the trench, covered lightly at first and then the dirt is gradually worked in at each cultivation during growth. While preparing and planting in the trench system requires more work than in the ordinary way, yet the culture is somewhat lessened and the rows kept cleaner with less work. The question with the large grower will be, Can the crop be in-

creased enough to justify the extra expenditure of labor? The old method of planting in drills will undoubtedly be continued until improved tools and machinery are invented for simplifying the work in the trench system.

Until that time, in suitable soil rightly managed, drill culture, light hilling, and deep planting afford the least expense and promise the greatest profit to the farmer.

CHAPTER XI.

LEADING VARIETIES.

Burpee's Extra Early.—We place this grand new potato at the head of the list, because we believe it to be the earliest first-class potato on the market, and the very best extra early potato grown. (Fig. 23.) It was first introduced by Messrs. W. Atlee Burpee & Co. in 1889, as Van Ornam's seedling, No. 37. It has been thoroughly tried in every State of the Union, in British Columbia, the Canadian provinces, and Europe, and is more widely grown throughout the world than any other early potato of recent introduction. Its claim of being from ten days to two weeks earlier than Early Rose, Beauty of Hebron, Early Puritan, Polaris, etc., and one week earlier than Early Ohio, has been fully substantiated. In the South, where it is now so extensively grown, Burpee's Extra Early seems better suited to the soil and climate than any of the foregoing varieties, and has proved the best market potato for shipping to the North.

It is a seedling from Early Rose, grows uniformly of good size, free from roughness or scab, and produces very few small tubers. It is oblong in shape, eyes few and near the surface, very smooth skin, creamy white, fine-grained flesh, slightly tinged with pink. Grows very compactly in the hill and near the surface. Foliage strong and vigorous, and of an intensely dark-green color. A sure cropper, good keeper, and immensely prolific. Eating qualities the very best.

Early Six Weeks Market.—This is evidently a seedling or sprout from Early Ohio; medium to large in size, oblong

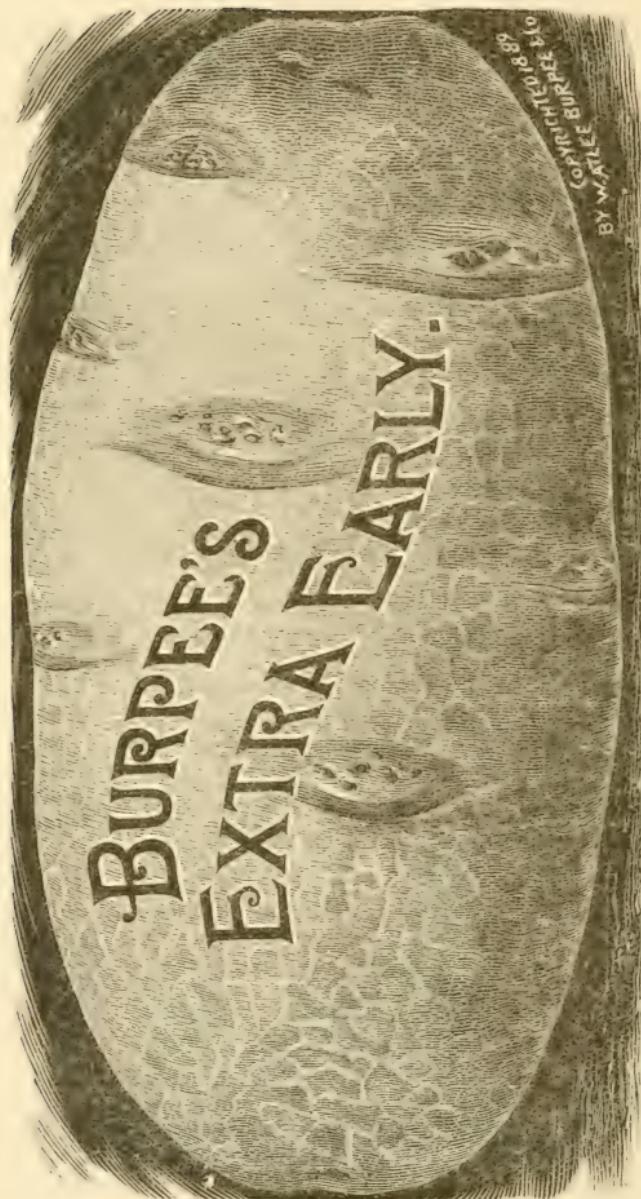


FIG. 23.

to round in shape, with few eyes near the surface, smooth, lightish pink color. Robust habits of growth, a fair cropper, and quality good.

Van Ornam's Earliest.—So nearly the counterpart of Burpee's Extra Early that its description is scarcely necessary. Tops not quite so large, tubers grow rather shorter and more full in center. Sets rather more in the hill, but does not grow quite so large. Is about the same in yield and quality.

Early Ohio.—Too well-known to need description here, except to say it is a grand cropper in most places.

Quality good and a splendid shipper, but very liable to scab with us.

Early Maine.—So closely resembling the Early Rose that few would be able to tell them apart, but a better cropper and about one week earlier. Fine eating qualities.

Early Puritan.—Owing to the small tops, may be planted somewhat closer than most varieties. A handsome, oblong potato; skin and flesh pure white. Cooks dry and floury, and is of excellent quality. It is very productive; the vines are of vigorous, upright growth, and the tubers mature as early as Early Rose. They are very dry and fit for table use when only half grown. A good cropper, but scabs some with us.

Beauty of Hebron.—Needs no description here; it has simply forged its way to the front on unquestioned merit. A rapid and vigorous grower, ripening as early as Early Rose, which it resembles but frequently exceeds in productiveness and excellence for table use.

Freeman.—No potato of late years has been so extensively advertised or more widely distributed. The tuber is oval-shaped, very smooth and handsome in appearance. Flesh pure white, both when raw and cooked, fine grained and of best flavor. A good cropper on suitable land; one of

the best keepers and shippers. A fine, medium early variety for the small gardener or amateur, but it requires the best land and careful culture, and is so very sensitive to extremes of weather that we do not believe it can ever become a standard and be grown by the average farmer.

Extra Early Walton.—We sent this variety out in 1891 as an extra early potato, but it has proved only medium early. Tops large, strong, and very robust, foliage thick, heavy, and intensely dark green. The tubers grow compactly in the hill, very large in size, and color of Early Rose. The heaviest cropper I have ever grown. "About perfect in quality," says the *Rural New Yorker*. It is as good as the Freeman, and will yield more than three times the crop of the former under ordinary circumstances.

Early Rose.—We need say but little regarding this grand old standard, which to-day retains all its fine qualities, and in many places its prolificness. It is the parent of more good potatoes than any other variety with which we are acquainted.

Early Polaris.—A grand potato closely resembling the Early Puritan.

The Great Divide.—The Great Divide (Figs. 24 and 25) was originated in Lewis, Cass County, Iowa, by me, from a seed-ball produced in 1887 on the Early Ohio, fertilized with the Old California.

The Old California was the heaviest-cropping and best keeping potato grown here. While of finest quality for table use, it was too rough and deep-eyed; it was very healthy and robust in growth, withstanding drought and insects better than any other variety known.

The vines of the Great Divide are stout, erect, and branching direct from the main stem; foliage plentiful, with dark-green leaves, withstanding drought, extreme heat, and attacks of insects admirably.

It is medium to late; perfectly free from disease, scab, or

blight. Tubers of oblong, round form; eyes plentiful and found on the surface, giving it a handsome appearance, and making almost no waste in paring. Skin very white, firm, and tough. Grows very compactly in the hill, and while the tubers are well under ground, they are borne near the surface of the soil. Size large to very large, with scarcely a small one. Our records show that in the past four years it has been an immense yielder of large, very smooth, fine-sized potatoes, and that it



FIG. 24.—Showing Habit of Growth in the Hill. (*From a photograph.*)

sets enough tubers always to produce a fine crop. Perfectly free from disease, its constitution seems iron-clad.

Flesh very white, and when baked or boiled, breaks open like a snowball,—white and floury; it cooks finely and very quickly, with a delicious nutty flavor.

It is the best keeper I have ever grown. Placed in a cellar October 15, 1892, when taken out for planting June 2, 1893, the tubers were without a sign of sprout, as firm and hard as

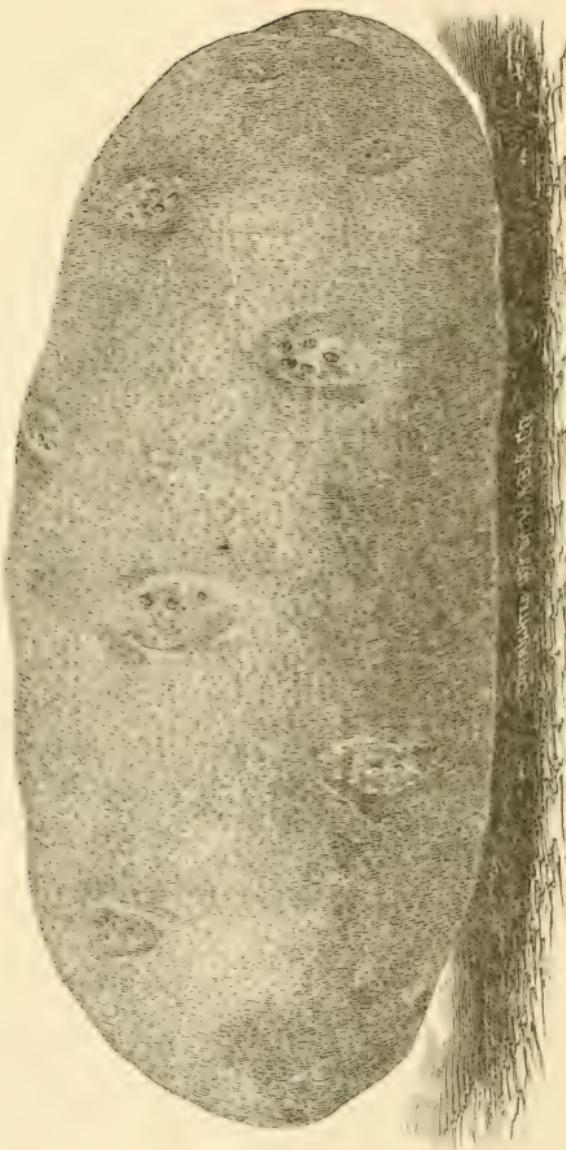


FIG. 25.—The Great Divide Potato.

when first dug. A tuber then tested for eating showed it had retained its fine flavor. Although we cut the tubers to single eye pieces, which we planted 18 inches apart, every eye grew, coming up quickly and finely, and producing a perfect stand. Taking the results of my careful records, supplemented by reports from Agricultural Experiment Stations and potato experts, received from almost every State, also from Europe, I consider it the most robust growing, heaviest cropping, longest keeping, and best shipping main-crop Potato in America. In fact, it is a peer of the Burbank in its palmiest days, while it is adapted to a greater variety of soils and climates.

It will produce a less percentage of small tubers in proportion to the whole crop than any other potato grown. It will succeed better on a greater variety of soils, and under wider extremes of temperature, and retain its fine quality and appearance.

Burpee's Empire State.—First introduced in 1885, the Empire State has had an immense sale and become very popular throughout the country. The potatoes are oblong in shape, of large size, smooth, and very handsome. It is a seedling raised by E. L. Coy from the only seed ball he had ever succeeded in finding on the White Elephant. It is rich and delicate in flavor, remarkably free from rot, is never hollow, and cooks evenly through without any coarseness; skin and flesh pure white, eyes plentiful and near the surface. It yields large crops, is easily dug and is a favorite in every market.

Burbank's Seedling.—Tops erect; strong and plentiful foliage; grows compactly in the hill. Skin white, somewhat rough, has many eyes, a trifle too deep. A splendid cropper, good keeper and of very fine quality.

Burpee's Superior.—Originated in 1884 (Fig. 26) from a seed ball found in a field of White Star. In shape it some-

what resembles its parent, but is more compact in form. It is usually covered with a fine netting, which always denotes a choice cooking quality. Its vigorous habit of growth enables it to withstand disease to a remarkable degree. The eyes lie very even with the surface. Both skin and flesh are very white. The tubers grow so compactly in the hill that they are easily harvested by hand or machine. They are medium late, and are the *most profitable for main crop* of all the standard varieties. They cook easily and quickly all through, having no hard or grainy core. Its texture is mealy, its flavor delicious

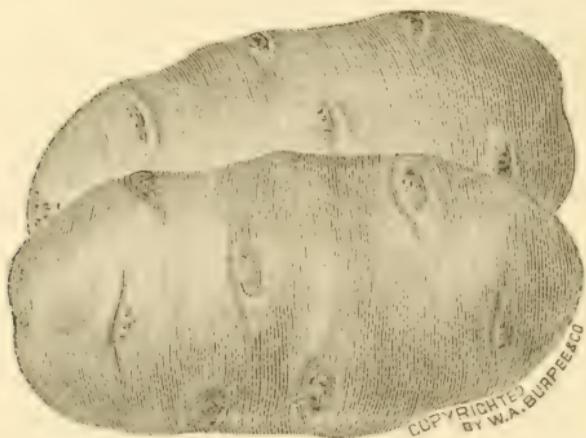


FIG. 26.—Burpee's Superior.

and *peculiarly rich* and *delicate*. Vines are strong and firm. Foliage heavy, and this enables it to withstand the ravages of that new and much to be dreaded enemy to potato growers,—the Cucumber Flea Beetle.

World's Fair.—A fine new potato, originated in Wisconsin. Vines rather spreading; small, plentiful foliage. Tubers round, oval, large size, grows somewhat scattering in the hill, but near the surface. Creamy white in color, and a grand table potato, being dry, floury, with a rich nutty flavor. A splendid cropper.

Rural New Yorker, No. 2.—This new potato (Fig. 27) originated on the experimental grounds of *The Rural New Yorker*, and although only introduced in 1889, has already created quite a *furore* among potato growers. As the agricultural papers have contained so many remarkable reports of this variety it is only necessary to say a few words descriptive of its merits. It is of very distinct and handsome appearance ; the tubers are of large size, with remarkable smoothness

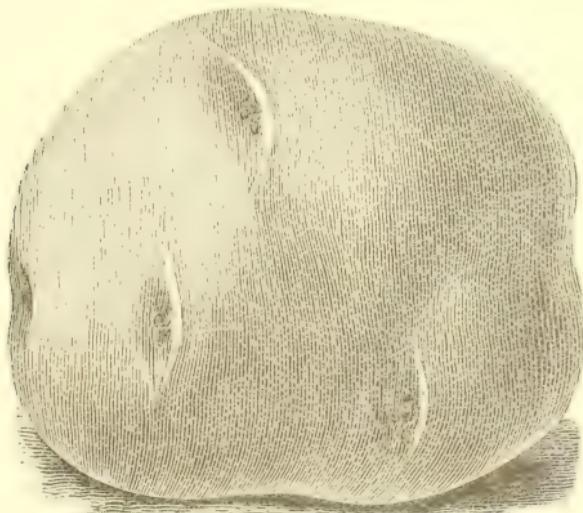


FIG. 27.—Rural New Yorker, No. 2.

of skin ; the eyes are few, distinct, and shallow. It is of extreme whiteness, both of skin and flesh, and unexcelled table qualities. It has great vigor in growth and solidity of tuber, which enable it to resist disease to a remarkable degree. Thoroughly tested throughout America and Europe, it has proved to be one of the most valuable varieties.

White Elephant, or Late Beauty of Hebron.—One of our best croppers and shippers. Skin and flesh pure white ;

cooks dry and mealy. Combines great productiveness, power of resisting disease, excellent quality, and great beauty.

Brownell's Winner.—This fine late potato, first introduced by Messrs. W. Atlee Burpee & Co. in 1890, originated with the late Mr. E. S. Brownell, of Vermont, who stated: "I originated No. 2000, or *Brownell's Winner*, in 1855, by hybridizing the White Star with the Peachblow. I consider it of superior quality, either baked or boiled; it cooks even, white, and dry. The vines are strong and healthy, and well calculated to resist the potato beetle. The tubers grow large, long, oval, slightly flattened, are very smooth and handsome, with few eyes. They grow compact in the hills, with few small ones. The color is a light rose-pink; it matures medium late, and is a great producer. I think it is superior in all respects to any variety that I have ever originated or grown."

Extra Early Vermont.—Similar in color, form, and general appearance to the Early Rose, from which it cannot be distinguished.

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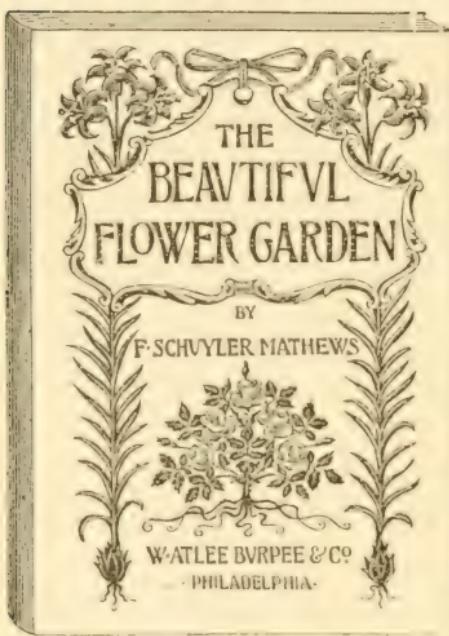
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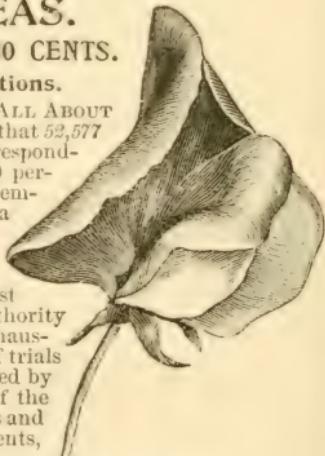
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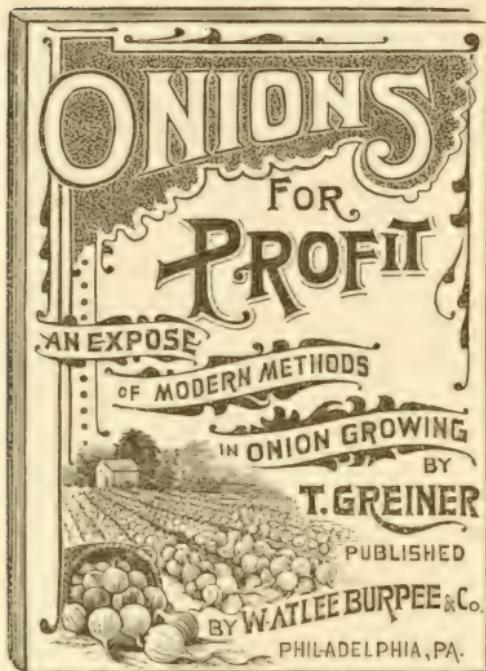
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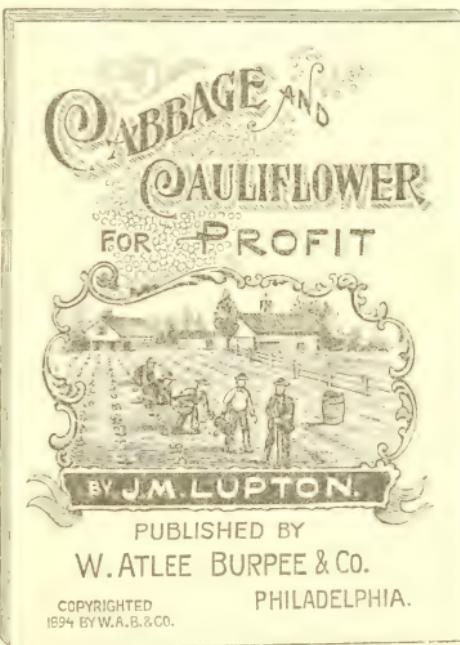
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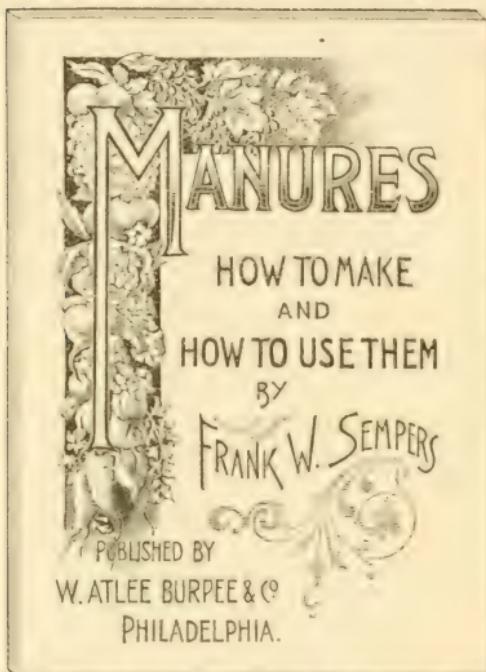
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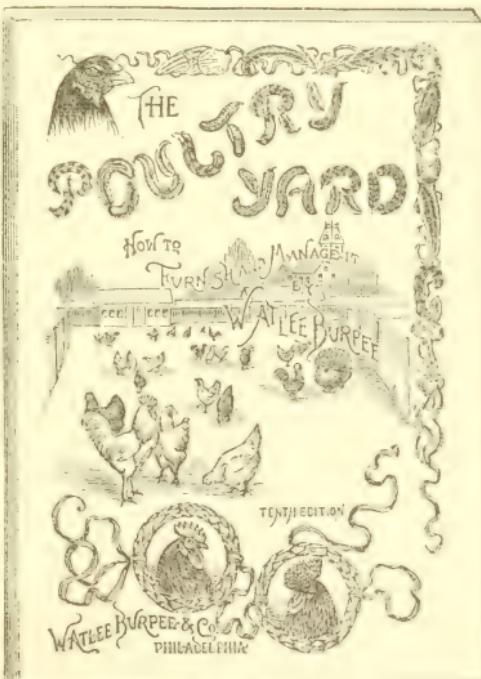
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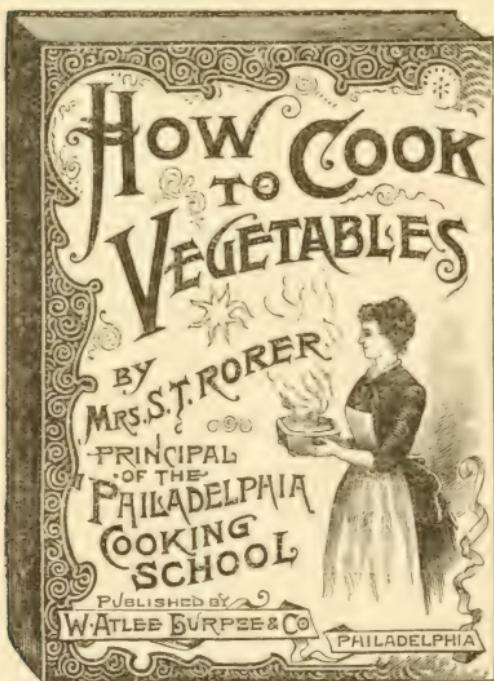


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